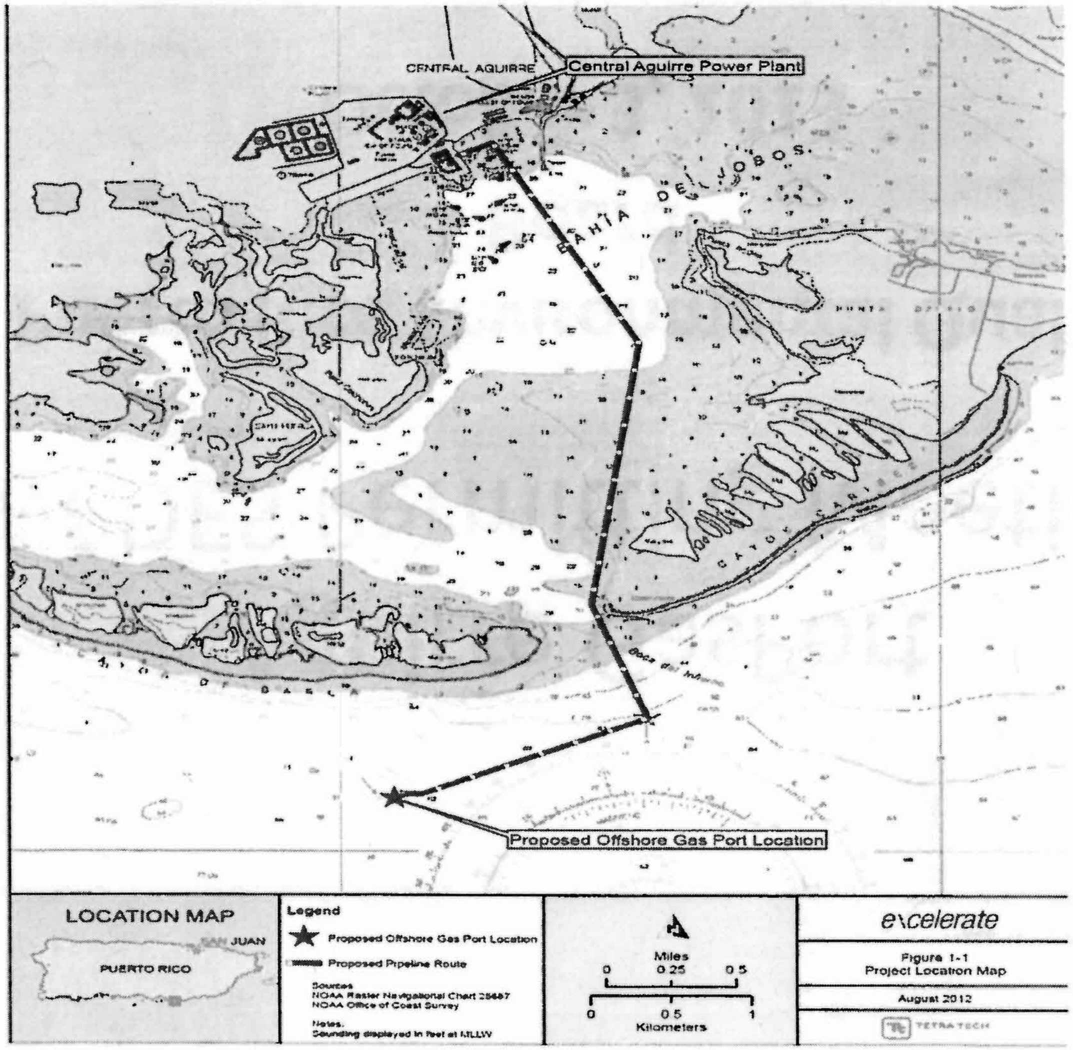
Aguirre GasPort
NPDES Permitting Meeting

Puerto Rico Environmental Quality Board

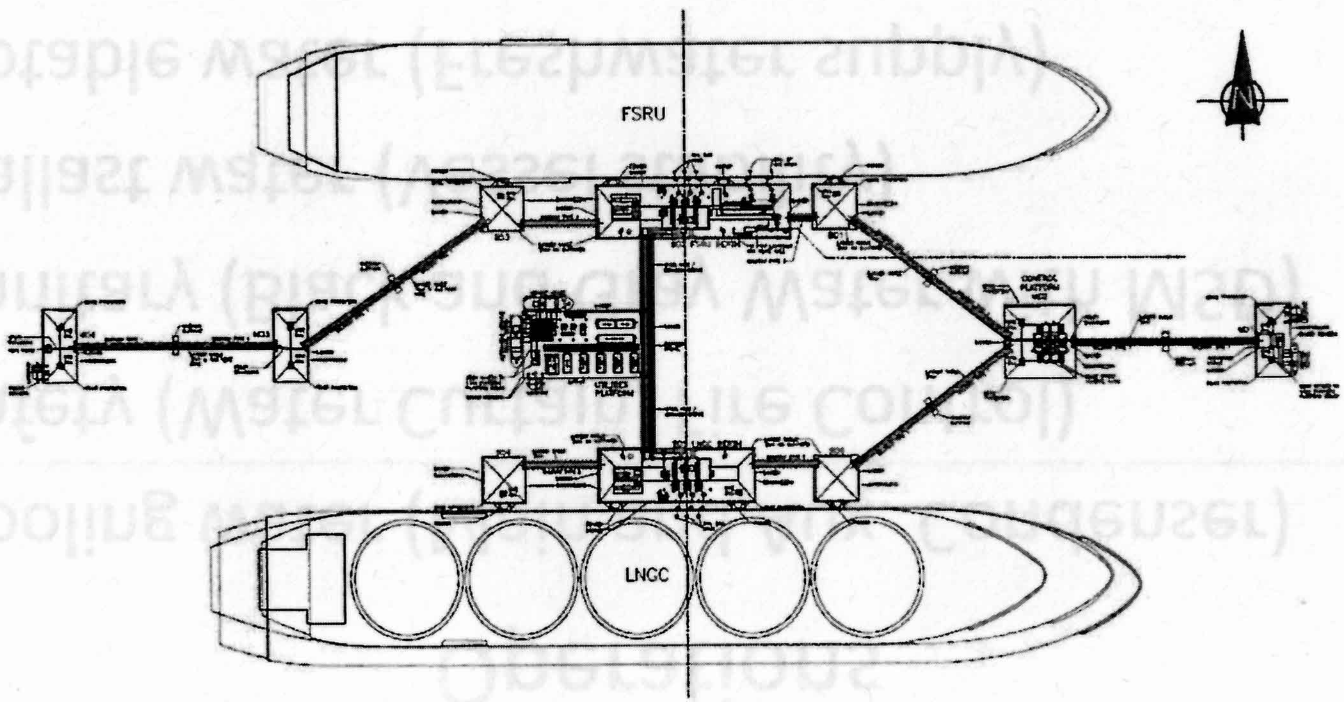
October 3, 2013

Aguirre GasPort



FSRU and Gas Port Layout

For presentation purposes only; Not to scale



GENERAL ARRANGEMENT

Figure 1-2

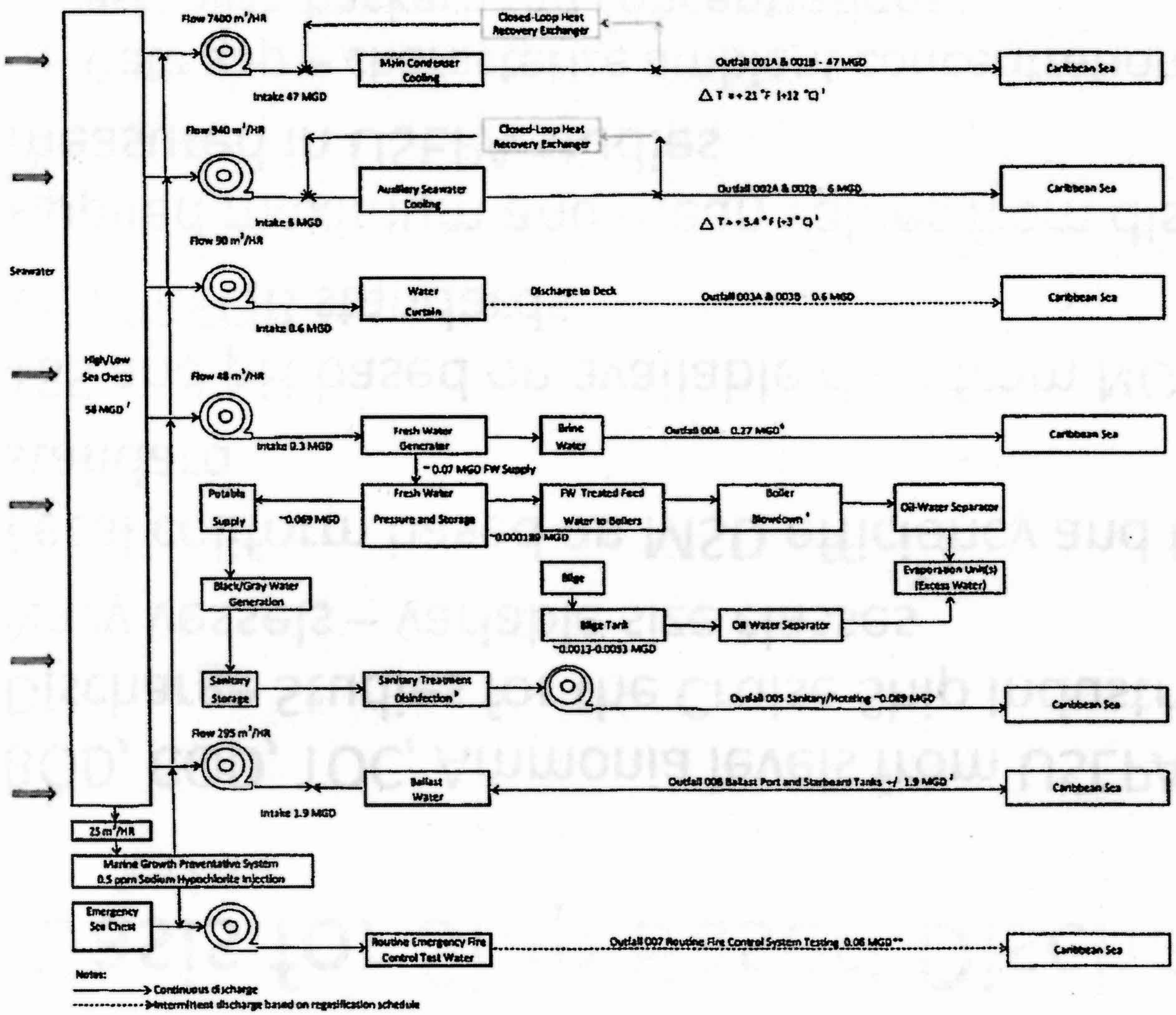
Discharges Associated with Ship Based Operations

- Cooling water (Main and Aux. Condenser)
- Safety (Water Curtain, Fire Control)
- Sanitary (Black and Gray Water with MSD)
- Ballast water (Vessel stability)
- Potable water (Freshwater supply)

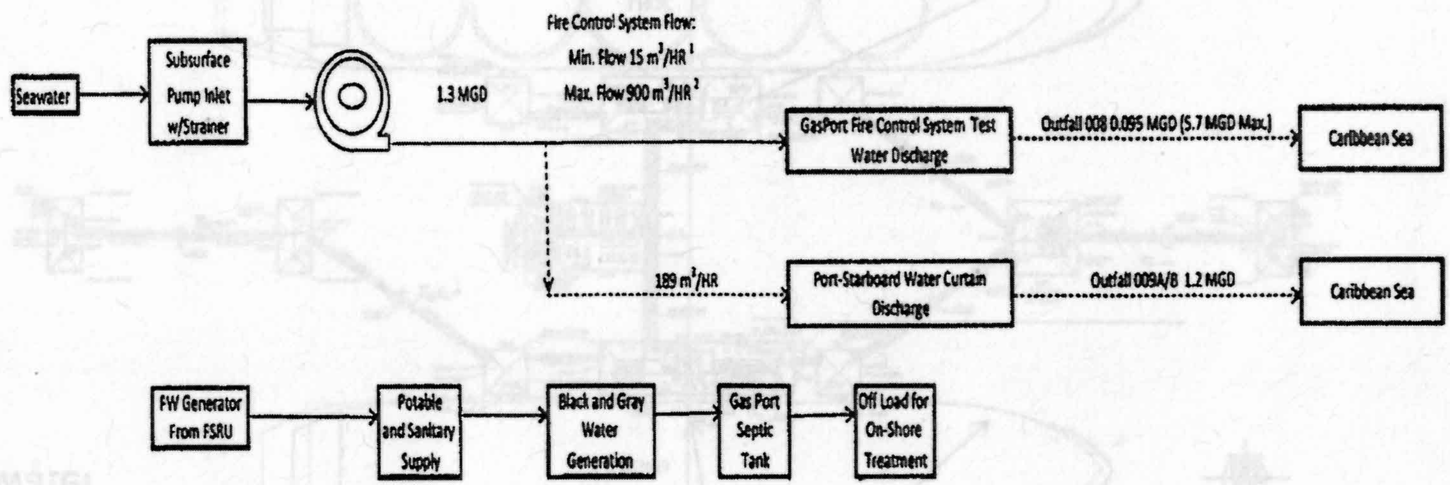
Basis for Ship Based Discharges

- BOD, COD, TOC, Ammonia levels from USEPA Nature of Discharge Studies for the Cruise Ship Industry and US Navy vessels – variable size classes
- Fecal coliform based on MSD efficiency and PREQB standard
- TSS and pH based on available data from NOAA buoys and PREQB standards
- Applied maximum and mean values from discharges measured in USEPA studies
  - Data gap – characterize ambient concentrations and establish background concentrations

Project Water Balance - FSRU



Project Water Balance - GasPort



Notes:

——→ Continuous discharge

- - - - → Intermittent discharge based on regasification schedule

[1] Minimum water withdrawal for on demand pressure maintance and service supply will be on routine basis

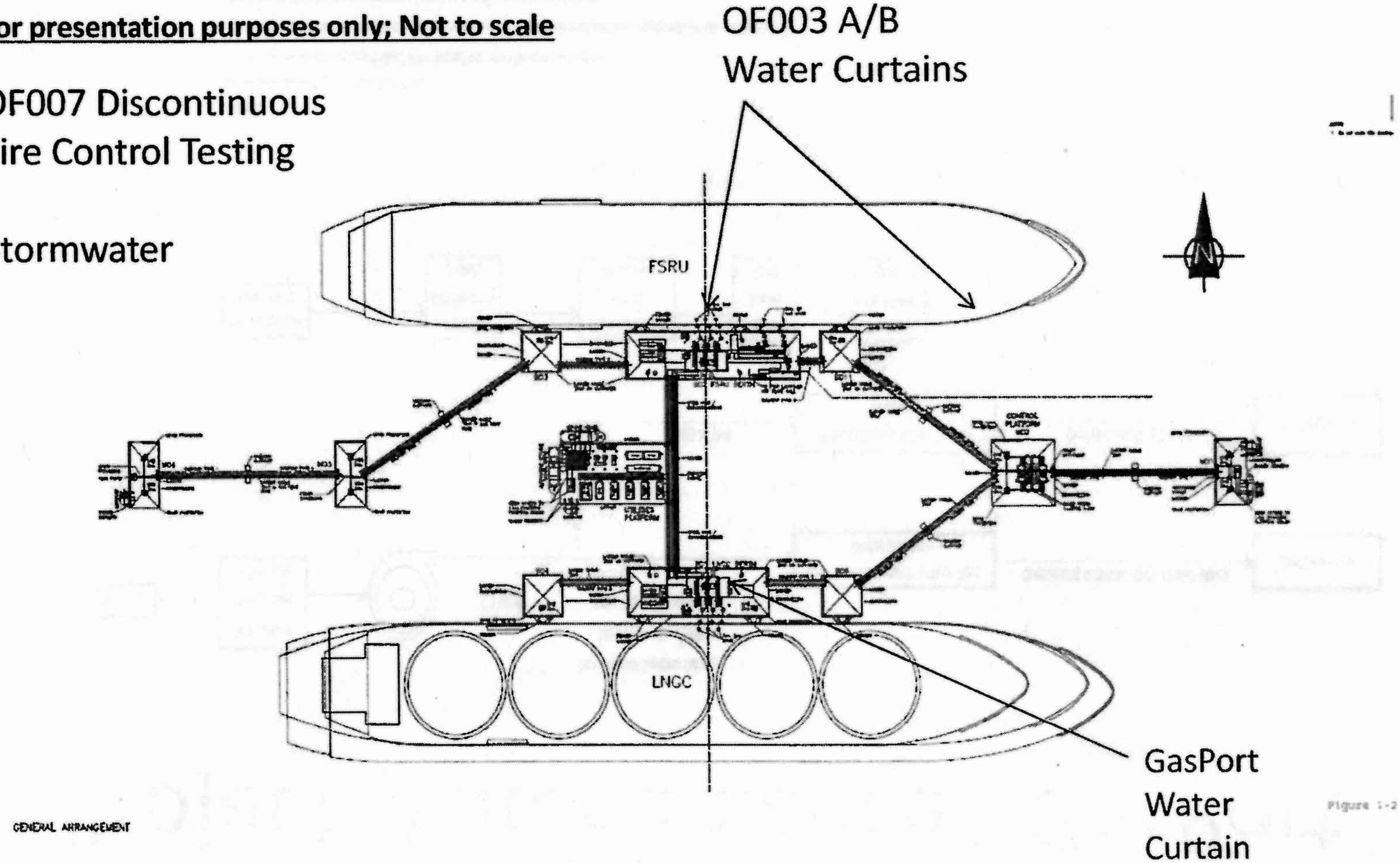
[2] Maximum flow based on emergency water supply operational demand.

FSRU Overdeck Discharges

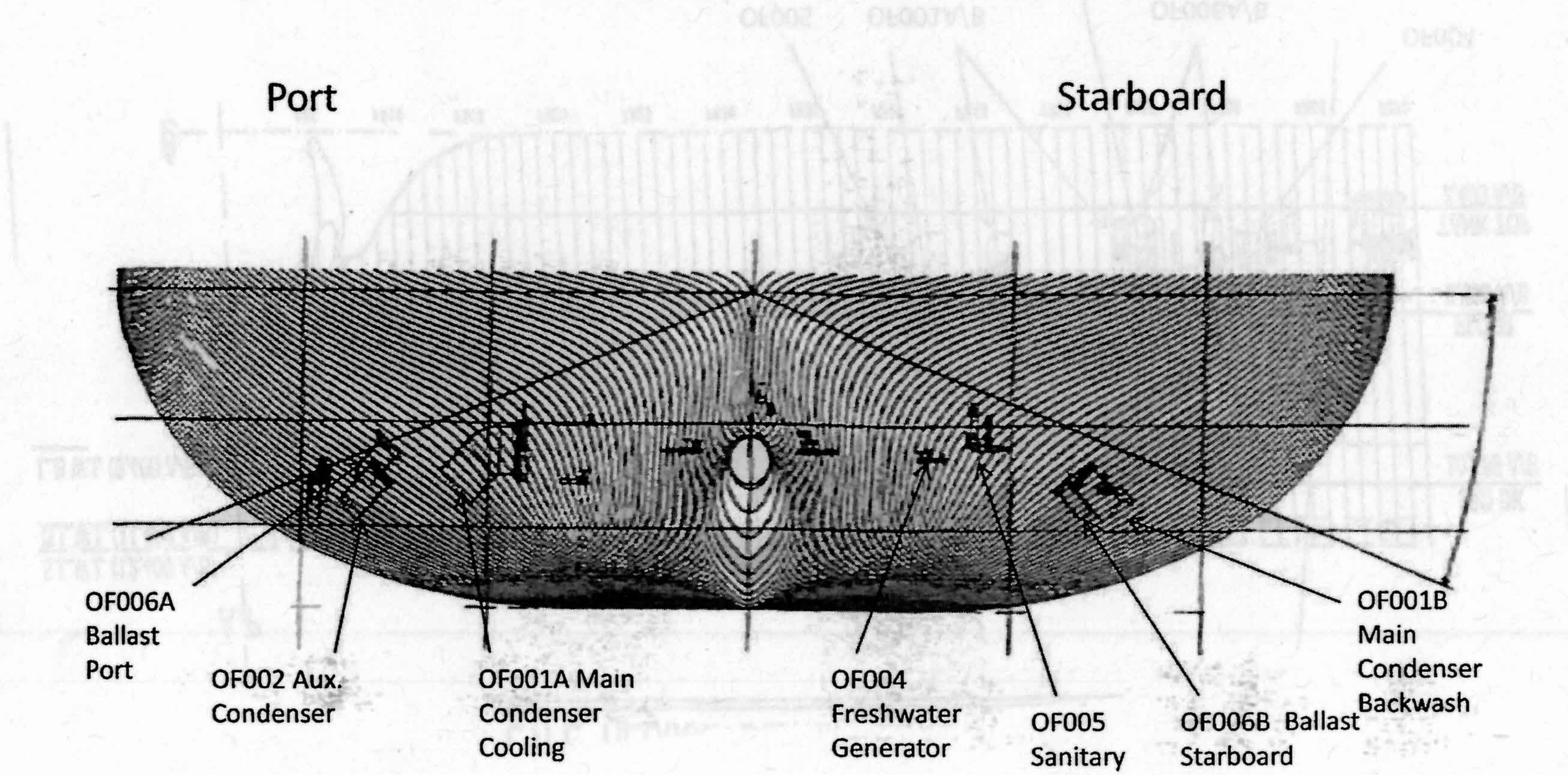
For presentation purposes only; Not to scale

OF007 Discontinuous
Fire Control Testing

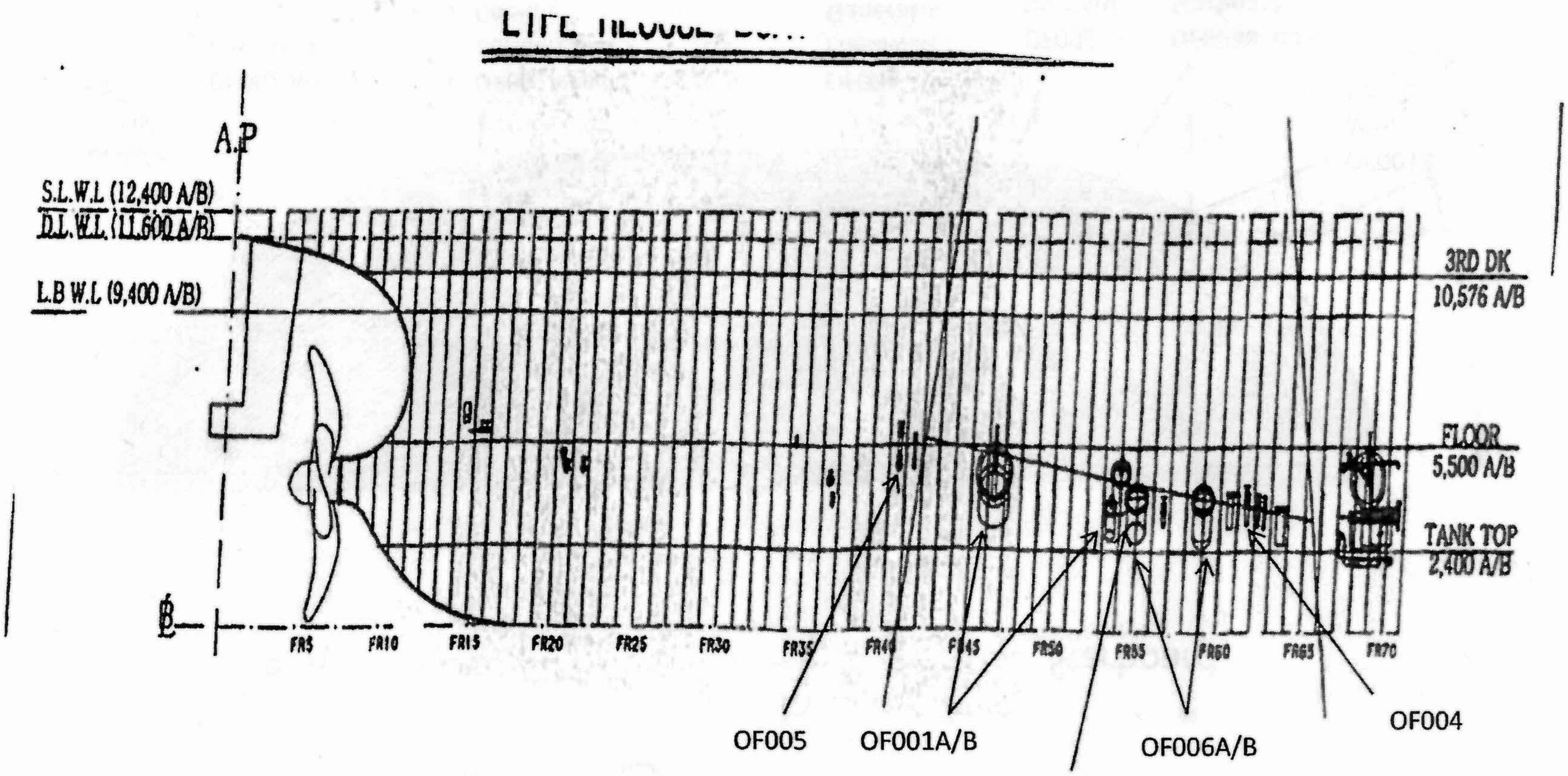
Stormwater



General Arrangement of Subsurface Discharges – Stern View



Cross Section Port-Starboard Discharges

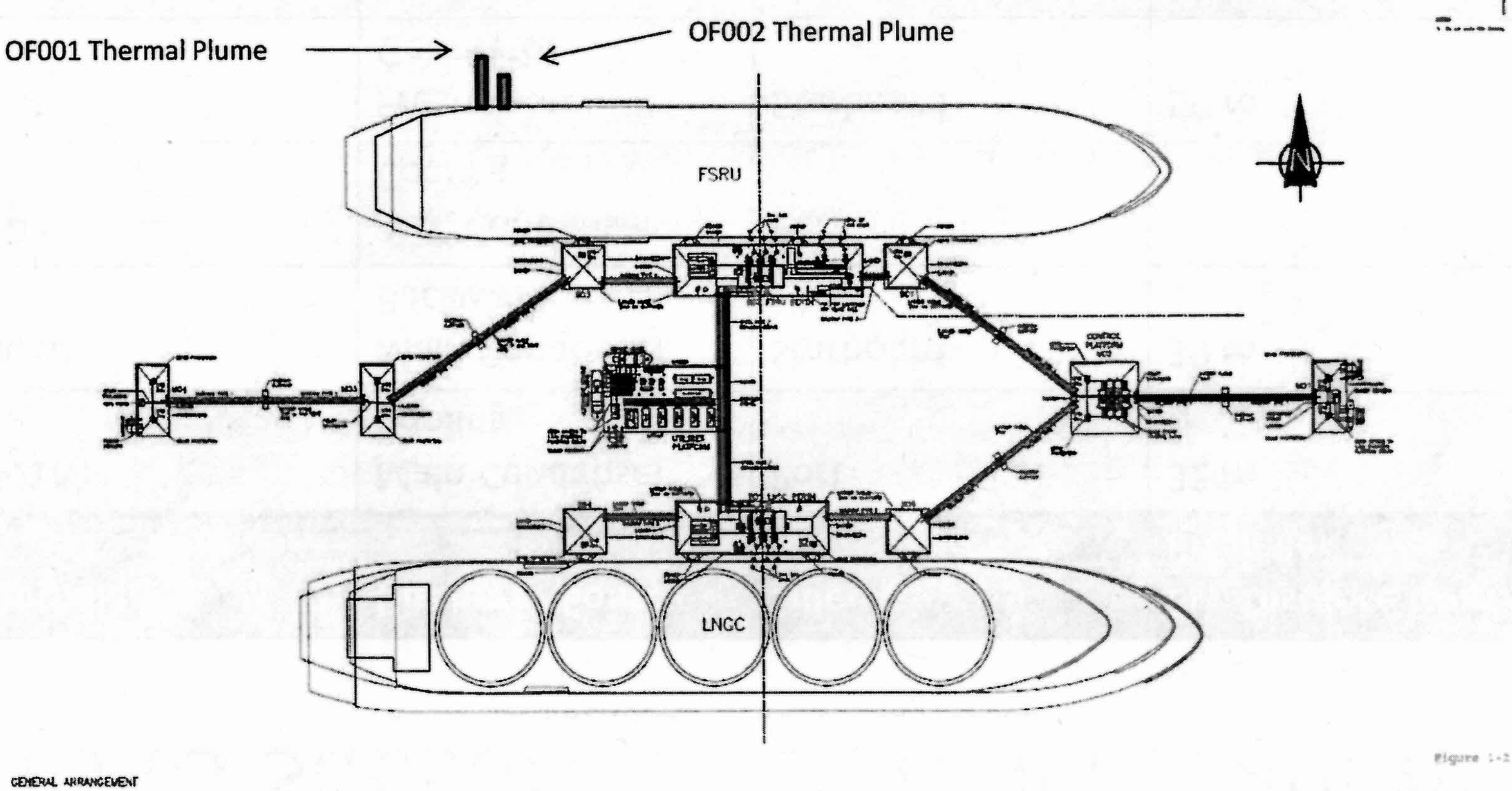


FSRU Subsurface Outfall Locations

Outfall	Discharge Source	Side	Est. Distance from Propeller
001A	Main Condenser Cooling	Port	32 m
001B	Main Condenser Backwash	Starboard	39 m
002	Aux. Condenser Cooling	Port	44 m
004	Freshwater Generator	Starboard	50 m
005	Sanitary	Starboard	28 m
006	Ballast	Port/Starboard	45 m/47 m

FSRU Thermal Plume Orientation

For presentation purposes only; Not to scale



FSRU Thermal Metrics

Vessel Discharge Property	FSRU Discharge 1 Outfall 001	FSRU Discharge 2 Outfall 002
Flow Rate, (cubic meters per second)	2.06	0.26
Discharge Port Diameter, (meters)	1.4	0.4
Port Area, (square meters)	1.54	0.126
Length Scale (square root of area), (meters)	1.24	0.35
Port Discharge Velocity, (meters/se)	1.34	2.06
Discharge Angle from Horizontal, (degrees)	-45	-45
Discharge Angle form Ambient Flow, (degrees)	90	90
Discharge Depth Range, (meters)	5.3 – 7.4	6.3 -8.4
Discharge Temperature Above Ambient (° C)	12	3
Maximum Ambient Temperature, (° C)	29.6	29.6
Water Depth, (meters)	19.2	19.2
Mean Tidal or Ambient Current, (meters/sec)	0.10	0.10
Not to Exceed Temperature Criteria, (° C)	32.2	32.2
EPA Guidance Mixing Zone (50 x length scale), (meters)	62	17.5

Thermal Discharge

- Outfall 001
  - Located approximately 32 m from propeller housing on stern
  - 56 MGD
  - Delta T max 12oC
  - Estimated point maximum discharge temp. 41 oC
  - Discharge rate of approx. 4.4 fps
  - Momentum based plume

FSRU Visual Plumes Model Outfall 001

Case	Discharge Depth, (meters)	Ambient Velocity, (meters/ Second)	Criteria (32.2° C / 90° F) or Bottom Impact Temperature, (° C)	Horizontal Distance to Meet Criteria or to Bottom Impact, (meters)	Depth to Meet Criteria or to Bottom Impact, (meters)
1	5.3	0	32.2	12.2	9.6
2	6.35	0	32.2	12.2	10.7
3	7.4	0	32.2	12.2	11.8
4	5.3	0.1	32.2	6.3	9.6
5	6.35	0.1	32.2	6.3	10.8
6	7.4	0.1	32.2	6.3	11.7

Visual Plumes is an approved model by EQB
Horizontal compliance within 12.2 m and 6.3 m at 0 and 0.1 m/sec current speed
Vertical compliance within 9.6 m to 11.7 m at 0 and 0.1 m/sec current speed

Main Condenser Thermal Plume

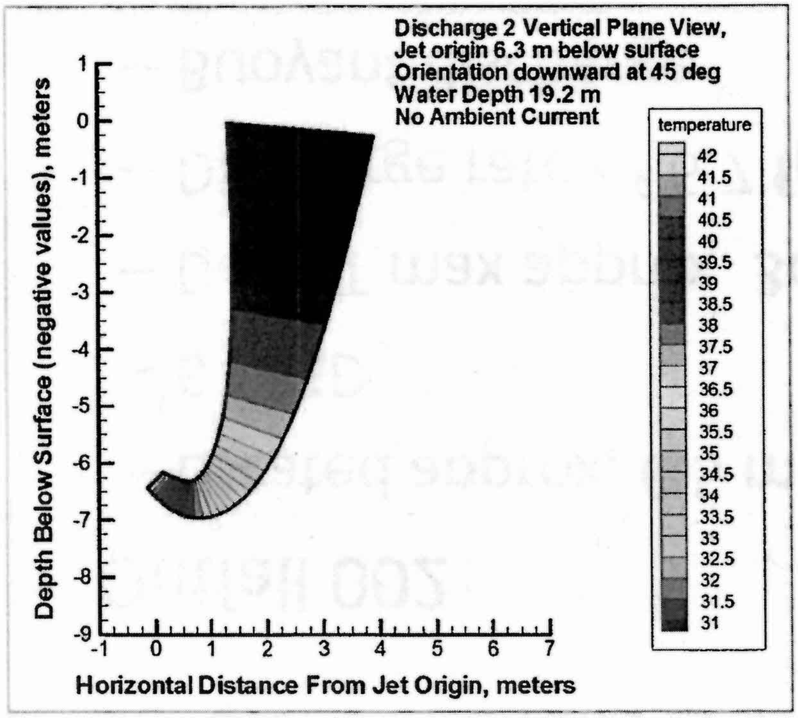
- Predicted plume meets predicted EPA standardized mixing zone application model No high speed diffuser applied in model
- Non-modified discharge

Thermal Discharge Characteristics

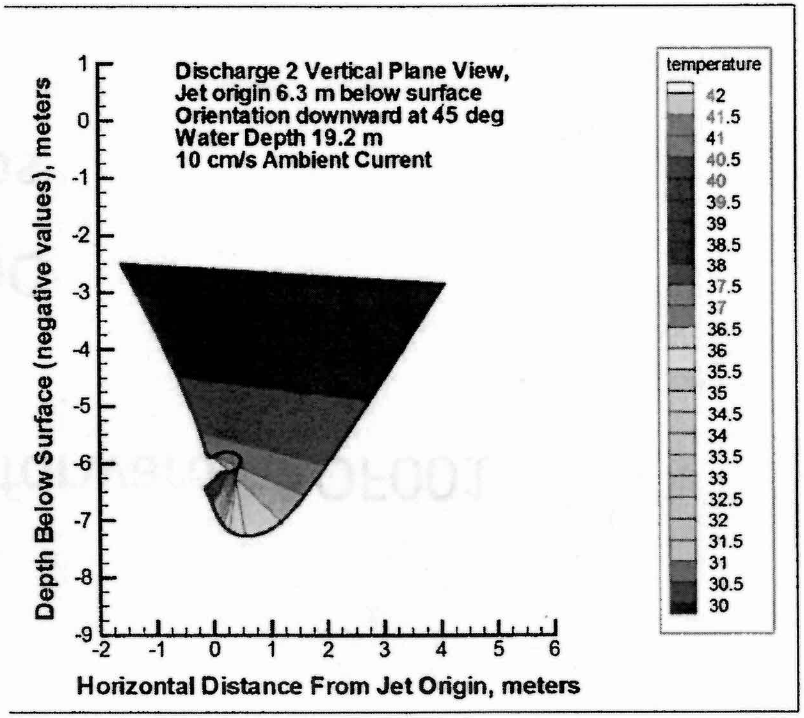
- Outfall 002
  - Located approx. 6.5 m forward of OF001
  - 6 MGD
  - Delta T max approx. 3oC
  - Discharge rate of 6.7 fps
  - Buoyant discharge

FSRU Outfall 002 with Jet Lag Model at 0 and 0.1 m/sec current speed

Thermal Signature – 0 m/sec



Thermal Signature – 0.1 m/sec



Visual Plumes not evaluated due to limitation on buoyant plume effect. Jet Lag Model applied.

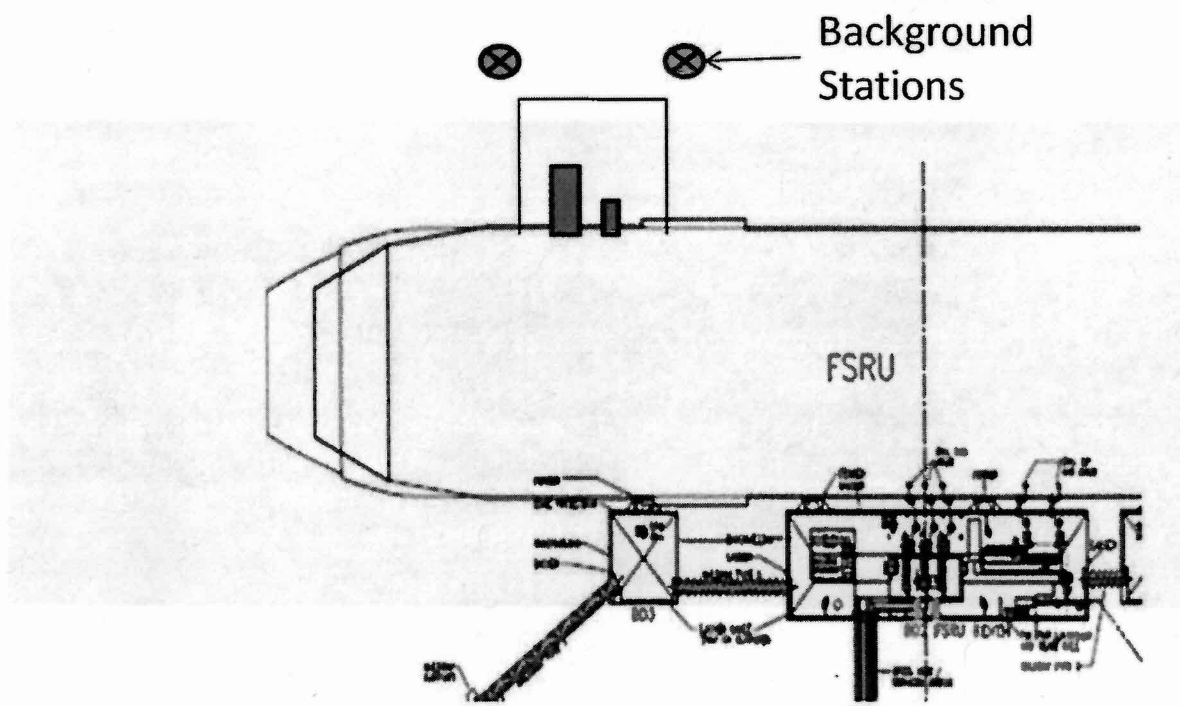
FSRU Jet Lag Model Outfall 002

Case	Discharge Depth, (meters)	Ambient Velocity, (meters/ Second)	Criteria (32.2° C / 90° F) or Bottom Impact Temperature, (° C)	Horizontal Distance to Meet Criteria or to Bottom Impact, (meters)	Depth to Meet Criteria or to Bottom Impact, (meters)
1	6.3	0	32.2	1.9	5.1
2	7.35	0	32.2	1.9	6.2
3	8.4	0	32.2	1.9	7.2
4	6.3	0.1	32.2	0.5	6.5
5	7.35	0.1	32.2	0.5	7.6
6	8.4	0.1	32.2	0.4	8.8

Horizontal compliance within 0.4 m and 6.2 m at 0 and 0.1 m/sec current speed
Vertical compliance within 5.1 m to 8.8 m at 0 and 0.1 m/sec current speed

Potential FSRU Mixing Zone Orientation

For presentation purposes only; Not to scale



Engineering – Diffusers or High Rate Diffuser

- Reconfiguration of discharge structures on hull:
  - Velocities are 4.4 fps and 6.7 fps, <10 fps as required for high speed diffuser definition
  - FSRU a vessel with need for underway capability on call
  - Engineering design of systems set for a sea going vessel
  - Structural hull limitations of hull due to drag from installed diffuser
  - Alteration of system has limited options due to ship based engineering system pressure limitations

Marine Growth Prevention System

- Chlorine based macrofouling control system
  - On board sodium hypochlorite generator, with target dose of 0.5 ppm injected after sea chest
  - All systems serviced by seawater withdrawal have the potential to contain free residual chlorine (FRC) in discharge
  - Continuous monitoring of chlorine using Hach monitoring system
  - Assessing discontinuous dosing and reduced continuous dosing as options

Sanitary Water Disinfection

- Chlorine based disinfection system
- Chlorine on-board sodium hypochlorite generator to supply
  - Install continuous monitoring system
  - Disinfection of Sanitary Effluent
    - Similar to POTW effluent
    - WET testing requirement to meet no toxics narrative in EQB standards

Additional Monitoring/Data Needs

- Temperature/Effluent Compliance
  - Vessel need for underway capability limits engineering and exterior structures
  - Mixing zone needs
- Background data needed to characterize local water quality
- Representative LNGC data for discharge profiles
- Chlorine and other Potential Contaminants
  - WET testing requirement
  - Evaluating discontinuous chlorination as option
  - Evaluating variable treatment capability

Please print or type in the unshaded areas only

Form Approved OMB No. 2040-0086

FORM 1 GENERAL — EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting)

I. EPA I.D. NUMBER

F			D

LABEL ITEMS	
I. EPA I.D. NUMBER	
III. FACILITY NAME	PLEASE PLACE LABEL IN THIS SPACE
V. FACILITY MAILING ADDRESS	
VI. FACILITY LOCATION	

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent (*the area to the left of the label space lists the information that should appear*), please provide it in the proper fill-in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI (*except VI-B which must be completed regardless*). Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of **bold-faced terms**.

SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED
A. Is this facility a **publicly owned treatment works** which results in a **discharge to waters of the U.S.**? (FORM 2A)		X		B. Does or will this facility (*either existing or proposed*) include a **concentrated animal feeding operation** or **aquatic animal production facility** which results in a **discharge to waters of the U.S.**? (FORM 2B)		X	
C. Is this a facility which currently results in **discharges to waters of the U.S.** other than those described in A or B above? (FORM 2C)		X		D. Is this a proposed facility (*other than those described in A or B above*) which will result in a **discharge to waters of the U.S.**? (FORM 2D)	X		X
E. Does or will this facility treat, store, or dispose of **hazardous wastes**? (FORM 3)		X		F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
I. Is this facility a proposed **stationary source** which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X		J. Is this facility a proposed **stationary source** which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an **attainment area**? (FORM 5)		X	

III. NAME OF FACILITY

1 SKIP Aguirre Offshore Gas Port

IV. FACILITY CONTACT

A. NAME & TITLE (*last, first, & title*)	B. PHONE (*area code & no.*)
2 Michael Trammel, Senior Director Environmental Affairs	(832) 813-7629

V. FACILTY MAILING ADDRESS

A. STREET OR P.O. BOX

3 1450 Lake Robbins Drive, Suite 200

B. CITY OR TOWN	C. STATE	D. ZIP CODE
4 The Woodlands	TX	77380

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER

5 3 miles Offshore from Jobos Bay

B. COUNTY NAME

Salinas County(Lat.17 deg. 54'14" Long. 66 deg. 13' 49")

C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE (*if known*)
6 Salinas	PR	00751	NA

CONTINUED FROM THE FRONT

VII. SIC CODES (4-digit, in order of priority)

A. FIRST		B. SECOND	
7 4924	(specify) Natural Gas Distribution	7 4923	(specify) Natural Gas Transmission and Distribution

C. THIRD		D. FOURTH	
7 4491	(specify) Marine Cargo Handling	7 1321	(specify) Natural Gas Liquids

VIII. OPERATOR INFORMATION

A. NAME

8 Excelerate Energy

B. Is the name listed in Item VIII-A also the owner?
☑ YES ☐ NO

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box: if "Other," specify.)

F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC (other than federal or state)
O = OTHER (specify)

P

(specify) NA

D. PHONE (area code & no.)

A (832) 813-7629

E. STREET OR P.O. BOX

1450 Lake Robbins Drive Suite 200

F. CITY OR TOWN	G. STATE	H. ZIP CODE
B The Woodlands	TX	77380

IX. INDIAN LAND

Is the facility located on Indian lands?
☐ YES ☑ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water)	9 N	NA
D. PSD (Air Emissions from Proposed Sources)	9 P	PFE-TV-4911-63-0796-005**
B. UIC (Underground Injection of Fluids)	9 U	NA
E. OTHER (specify)	9	NA (specify) NA
C. RCRA (Hazardous Wastes)	9 R	NA
E. OTHER (specify)	9	NA (specify) NA

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers, and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS (provide a brief description)

A floating storage regasification unit (FSRU) will be moored to an offshore GasPort Terminal located in the Caribbean Sea outside of Jobos Bay. The FSRU will regasify liquefied natural gas (LNG) supplied by liquefied natural gas carriers (LNGCs)that will moor to the GasPort Terminal every 1-2 weeks depending upon demand from the Aguirre Power Plant owned by the Puerto Rico Electric Power Authority (PREPA). The regasified natural gas will be delivered via submarine pipeline to the PREPA Aguirre Power Plant.

** PREPA Aguirre Power Plant Air Permit Number

XIII. CERTIFICATION (see instructions)

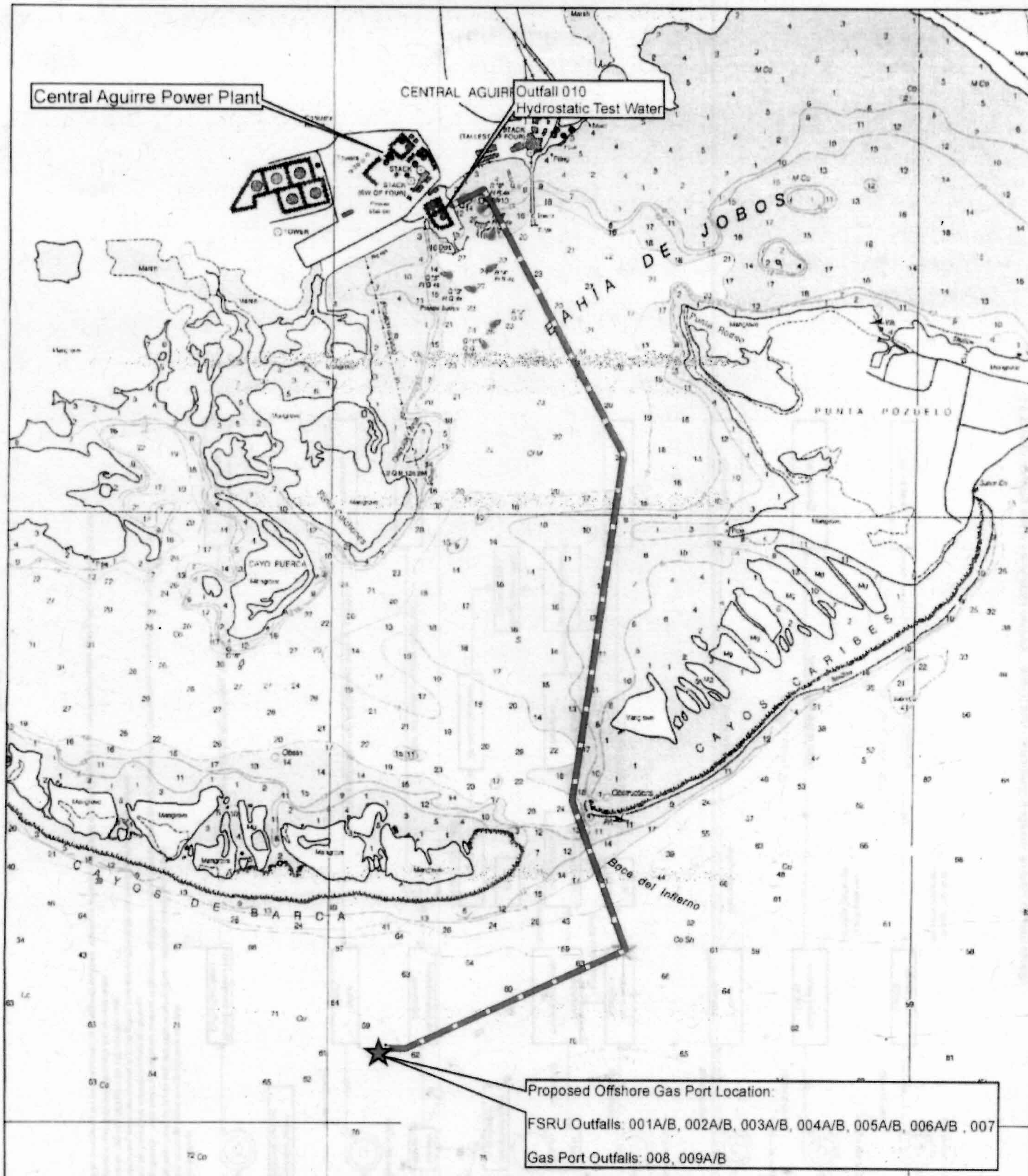
I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)	B. SIGNATURE	C. DATE SIGNED
EDWARD SCOTT, COO	[signature]	3 July 2013

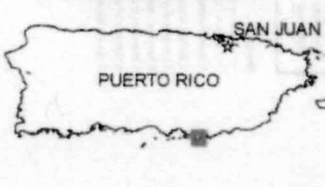
COMMENTS FOR OFFICIAL USE ONLY

C

EPA Form 3510-1 (8-90)



LOCATION MAP



Legend

Proposed Offshore Terminal

Proposed Pipeline Route

Sources
NOAA Raster Navigational Chart 25687
NOAA Office of Coast Survey

Notes
Sounding displayed in feet at MLLW

Kilometers
0 0.25 0.5 1

0 0.25 0.5
Statute Miles

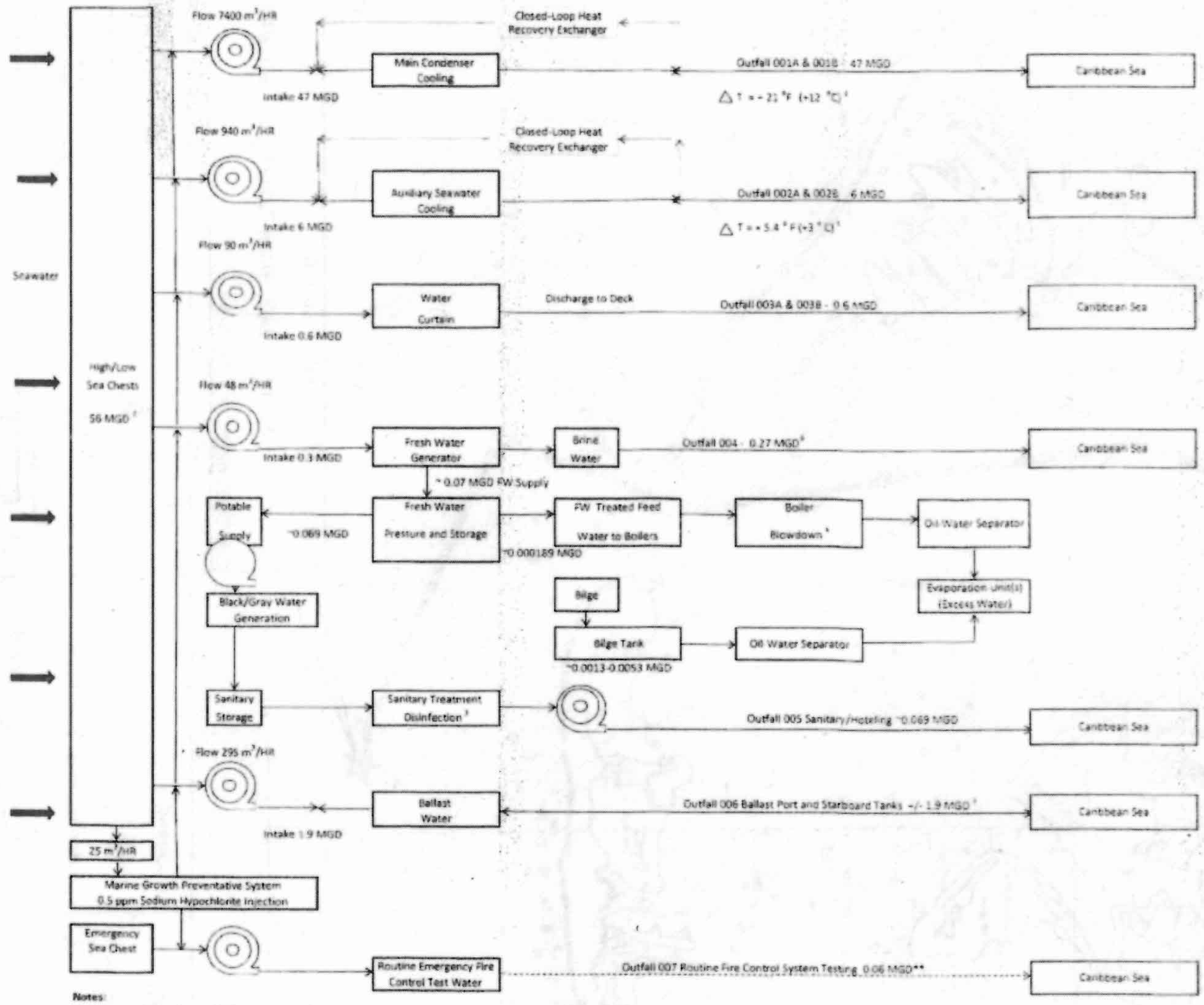
excelerate energy

Figure 1
Project and Outfall Location Map

June 2013

TETRA TECH

Aguirre GasPort Floating Storage Regasification Unit (FSRU) - Revised Preliminary Water Balance V1 5-21-13



Notes:

→ Continuous discharge

- - - → Intermittent discharge based on regasification schedule

1 Water withdrawal and discharge based on closed loop and FRSU vessel readiness operation during regasification

2 Ballast water will vary significantly. Value based on Northeast Gateway Projectwith regasification process and on-board storage capacity of the FSRU and may cycle volumes of up to 10,000 m³/hr.

3 On board gray/black water treatment and disinfection prior to discharge

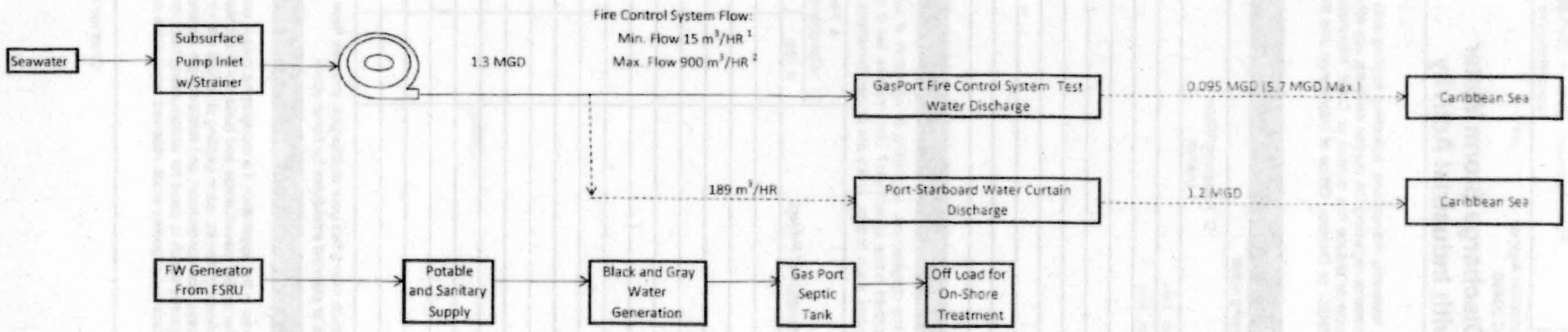
4 Assumes that 2 Main Boilers have maximum volume of 3,100 gallons each and auxillary boiler has maximum volume of 310 gallons

5 Assumes a sanitary generation rate of 0.069 MGD for 100 member crew

6 Volume of discharge dependent upon daily potable supply and demand needs

7 An additional 960 m³/HR for emergency fire control system via emergency sea chest. Maximum withdrawal of 6 MDG only for emergency use. Intermittent routine testing will use estimated 0.06 MGD

Aguirre Gas Port Platform - Preliminary Water Balance V1 5-30-13



Notes:

→ Continuous discharge

⇢ Intermittent discharge based on regasification schedule

[1] Minimum water withdrawal for on demand pressure maintance and service supply will be on routine basis

[2] Maximum flow based on emergency water supply operational demand.

Please print or type in the unshaded areas only

EPA ID Number *(copy from Item 1 of Form 1)*

Form Approved. OMB No. 2040-0086
Approval expires 5-31-92

FORM **2F** NPDES

EPA

U.S. Environmental Protection Agency
Washington, DC 20460

Application for Permit to Discharge Storm Water Discharges Associated with Industrial Activity

Paperwork Reduction Act Notice

Public reporting burden for this application is estimated to average 28.6 hours per application, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate, any other aspect of this collection of information, or suggestions for improving this form, including suggestions which may increase or reduce this burden to: Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460, or Director, Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

I. Outfall Location

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. Outfall Number *(list)*	B. Latitude			C. Longitude			D. Receiving Water *(name)*
FSUR Stormwater	17.00	54.00	14.00	66.00	13.00	49.00	Caribbean Sea
GasPortStormwater	17.00	54.00	14.00	66.00	13.00	49.00	Caribbean Sea

II. Improvements

A. Are you now required by any Federal, State, or local authority to meet any implementation schedule for the construction, upgrading or operation of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

1. Identification of Conditions, Agreements, Etc.	2. Affected Outfalls		3. Brief Description of Project	4. Final Compliance Date	
	number	source of discharge		a. req	b. proj
NONE	NA	NA	NA		

B. You may attach additional sheets describing any additional water pollution (or other environmental projects which may affect your discharges) you now have under way or which you plan. Indicate whether each program is now under way or planned, and indicate your actual or planned schedules for construction.

III. Site Drainage Map

Attach a site map showing topography (or indicating the outline of drainage areas served by the outfalls(s) covered in the application if a topographic map is unavailable) depicting the facility including: each of its intake and discharge structures; the drainage area of each storm water outfall, paved areas and buildings within the drainage area of each storm water outfall, each known past or present areas used for outdoor storage of disposal of significant materials, each existing structural control measure to reduce pollutants in storm water runoff, materials loading and access areas, areas where pesticides, herbicides, soil conditioners and fertilizers are applied, each of its hazardous waste treatment, storage or disposal units (including each area not required to have a RCRA permit which is used for accumulating hazardous waste under 40 CFR 262.34); each well where fluids from the facility are injected underground; springs, and other surface water bodies which received storm water discharges from the facility.

 Continue on Page 2

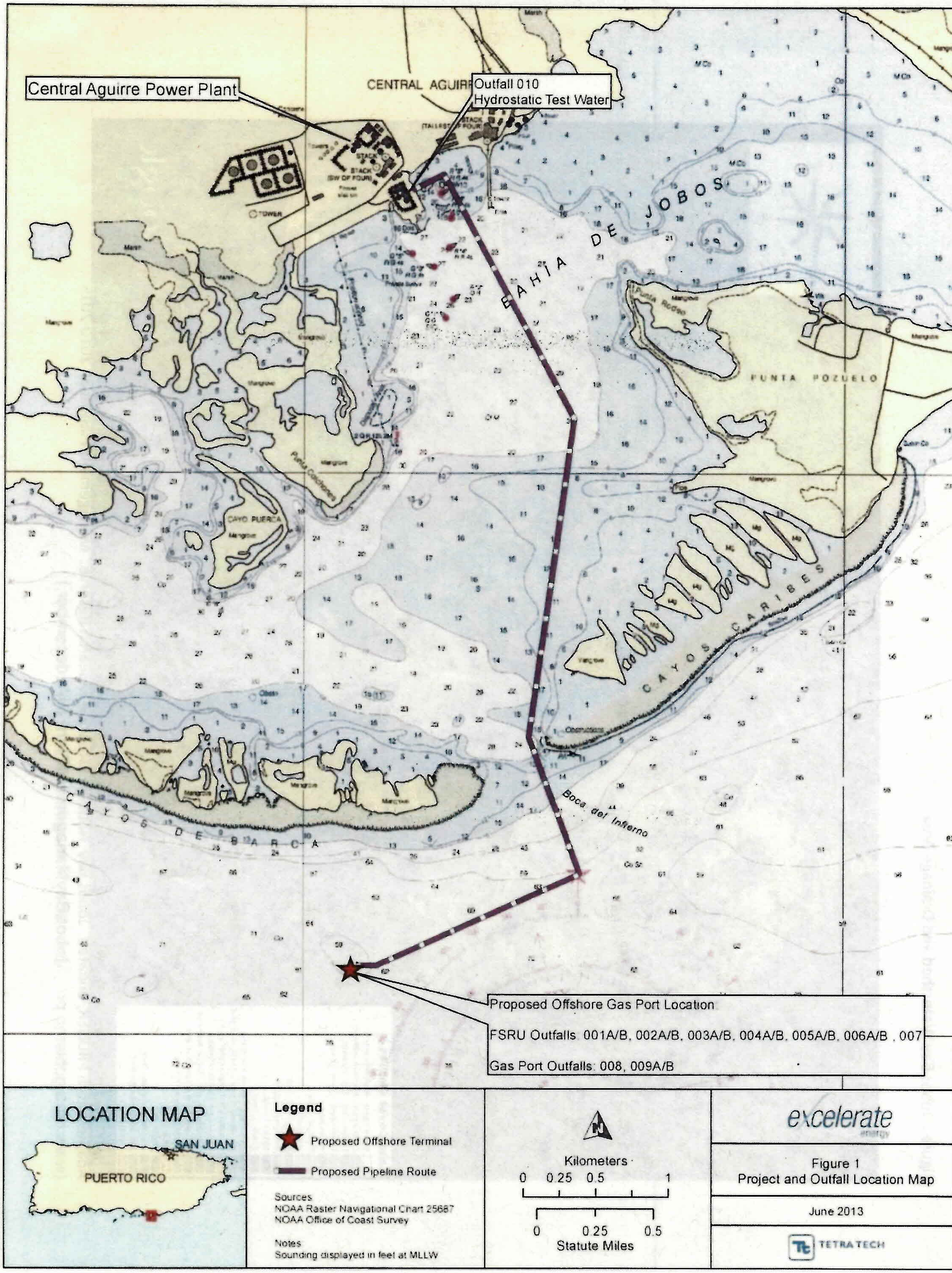
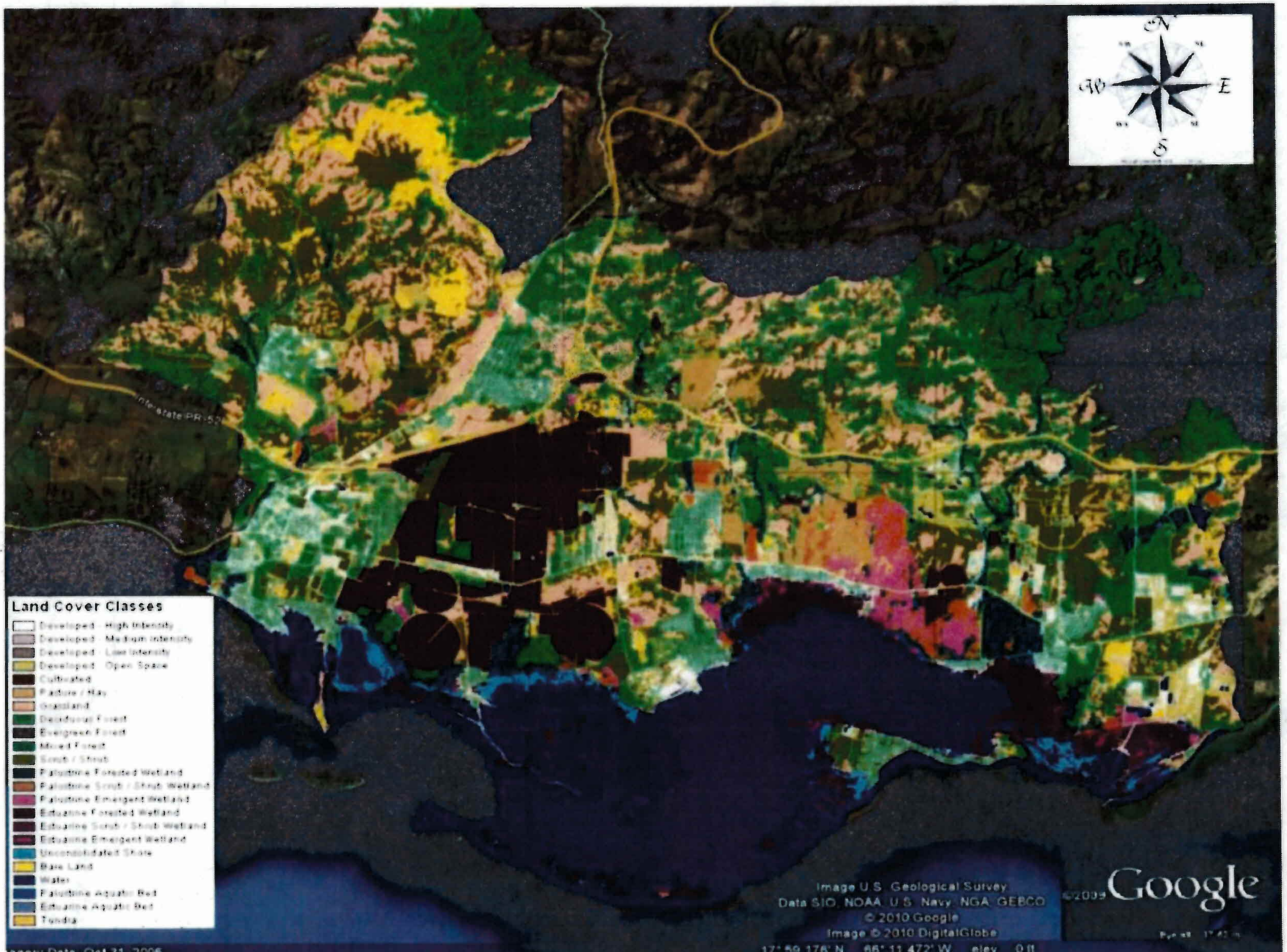
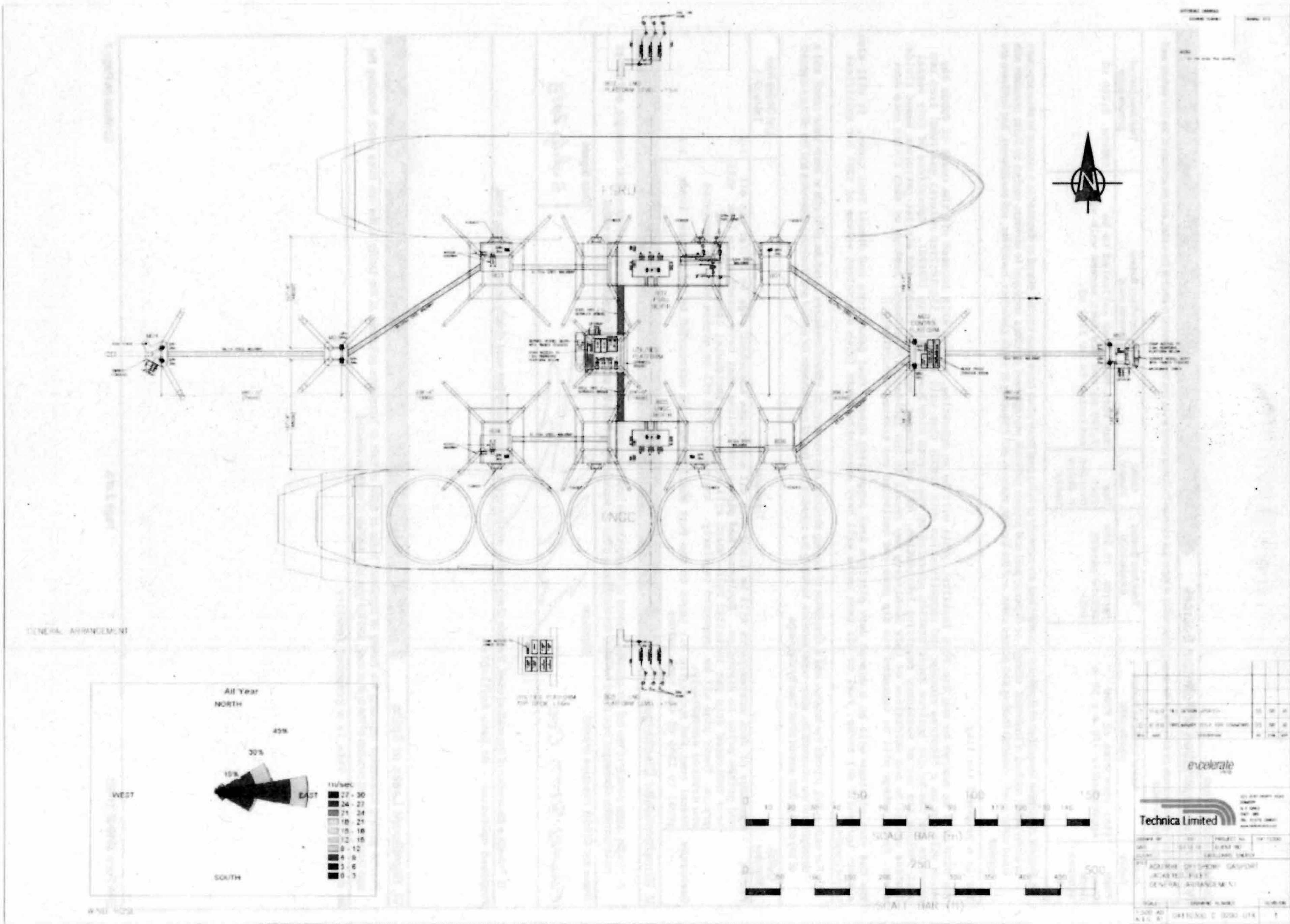


Figure 1
Project and Outfall Location Map

Figure 2 Jobos Bay Watershed and Drainage Area.



Adapted from PRDNER, undated. Jobos Bay National Estuarine Research Reserve. Management Plan Final 2010-2015 (www.drna.gobierno.pr/.../**JobosBayManagementPlan**FINALdecember.)


FSRU
LNGC
UTILITIES PLATFORM
CONTROL PLATFORM
GENERAL ARRANGEMENT
All Year
NORTH
WEST
EAST
SOUTH
10%
30%
45%
m/sec
27 - 30
24 - 27
21 - 24
18 - 21
15 - 18
12 - 15
9 - 12
6 - 9
3 - 6
0 - 3
SCALE BAR (m)
SCALE BAR (ft)
excelerate
Technica Limited
AGUIRRE OFFSHORE GASPORT
JACKETED PILES
GENERAL ARRANGEMENT

Continued from the Front

IV. Narrative Description of Pollutant Sources

A. For each outfall, provide an estimate of the area (include units) of imperious surfaces (including paved areas and building roofs) drained to the outfall, and an estimate of the total surface area drained by the outfall

Outfall Number	Area of Impervious Surface *(provide units)*	Total Area Drained *(provide units)*	Outfall Number	Area of Impervious Surface *(provide units)*	Total Area Drained *(provide units)*
FSRU Over deck stormwa ter	Flat Deck area of FSRU approximates 300 m x 50 m	Approx. 15,000 square meters (m2)	Gas Port Overdeck Storm water	Gas Port Deck Area estimated to be 7,300 m2 and Gas Port access walk ways estimated to be 1900 m2.	Approx. 9,200 m2

B. Provide a narrative description of significant materials that are currently or in the past three years have been treated, stored or disposed in a manner to allow exposure to storm water; method of treatment, storage, or disposal; past and present materials management practices employed to minimize contact by these materials with storm water runoff; materials loading and access areas, and the location, manner, and frequency in which pesticides, herbicides, soil conditioners, and fertilizers are applied.

Ths is a proposed facility:

The FSRU will be moored to the Gas Port facility. This will be an operating, moored ship located off the coast of Jobos Bay which will act as a floating storage and regasification unit (FSRU) that will regasify liquidified natural gas (LNG) from LNG carriers for use by the Aguirre Power Station operated by the Puerto Rico Power Authority (PREPA). Operations of this vessel will include the use of machinery requiring lubrication, (oil and grease), hydraulic fluids and similar petroleum based fluids. Routine operation and maintaince of this machincery may result in the incidental/accidental leakage of such fluids onto deck areas. Such leakage will be captured via dip pans and collected and treated accordingly.

The Gas Port platform will be a manned deck platform area supporting diesel fuel generators and diesel fuel tanks. It will also support hydraulic oil tanks. Fuel or oil tank units will have associated bunds (with equivalent volume of 120% for spill/leak containment.

C. For each outfall, provide the location and a description of existing structural and nonstructural control measures to reduce pollutants in storm water runoff; and a description of the treatment the storm water receives, including the schedule and type of maintenance for control and treatment measures and the ultimate disposal of any solid or fluid wastes other than by discharge.

Outfall Number	Treatment	List Codes from Table 2F-1
PSRUSW	Openings of deck drains/ports will be lined with oil and grease absorbent pigs to filter out oil and grease prior to discharge. Equipment and piping connections that have potential to leak will have dedicated drip pan installed below which will capture any incidental leakage of oil or grease. These pans wil be inspected regularly. Any accumulated oil or grease will be recovered and treated accordingly.	1-X
GasPortSW	Diesel fuel and hydraulic oil tanks on Gas Port platform will be surrounded by containment bunds equal to 120% of the tank volume.	1-X

V. Nonstormwater Discharges

A. I certify under penalty of law hat the outfall(s) covered by this application have been tested or evaluated for the presence of nonstormwater discharges, and that all nonstormwater discharged from these outfall(s) are identified in either an accompanying Form 2C or From 2E application for the outfall.

Name and Official Title *(type or print)*	Signature	Date Signed
EDWARD SCOTT, COO		3 July 2013

B. Provide a description of the method used, the date of any testing, and the onsite drainage points that were directly observed during a test.

Proposed operation - No Data Available

VI. Significant Leaks or Spills

Provide existing information regarding the history of significant leaks or spills of toxic or hazardous pollutants at the facility in the last three years, including the approximate date and location of the spill or leak, and the type and amount of material released.

No data available. This is a proposed facility.

 Continue on Page 3

Continued from Page 2

EPA ID Number *(copy from Item 1 of Form 1)*

VII. Discharge Information

A, B, C, & D: See instructions before proceeding. Complete one set of tables for each outfall. Annotate the outfall number in the space provided. Table VII-A, VII-B, VII-C are included on separate sheets numbers VII-1 and VII-2.

E. Potential discharges not covered by analysis – is any toxic pollutant listed in table 2F-2, 2F-3, or 2F-4, a substance or a component of a substance which you currently use or manufacture as an intermediate or final product or byproduct?

☐ Yes *(list all such pollutants below)* ☑ No *(go to Section IX)*

VIII. Biological Toxicity Testing Data

Do you have any knowledge or reason to believe that any biological test for acute or chronic toxicity has been made on any of your discharges or on a receiving water in relation to your discharge within the last 3 years?

☐ Yes *(list all such pollutants below)* ☑ No *(go to Section IX)*

IX. Contract Analysis Information

Were any of the analyses reported in Item VII performed by a contract laboratory or consulting firm?

☐ Yes *(list the name, address, and telephone number of, and pollutants analyzed by, each such laboratory or firm below)* ☑ No *(go to Section X)*

A. Name	B. Address	C. Area Code & Phone No.	D. Pollutants Analyzed

X. Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. Name & Official Title *(Type Or Print)*	B. Area Code and Phone No.
EDWARD SCOTT, COO	832-813-7100
C. Signature	**D. Date Signed**
	3 July 2013

EPA ID Number (*copy from Item 1 of Form 1*)

Form Approved. OMB No. 2040-0086
Approval expires 5-31-92

VII. Discharge information *(Continued from page 3 of Form 2F)*

Part A – You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details

Pollutant and CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-Weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-Weighted Composite		
Oil and Grease	NA	N/A	NA	NA	0.00	NA
Biological Oxygen Demand (BOD5)	NA	NA	NA	NA	0.00	NA
Chemical Oxygen Demand (COD)	NA	NA	NA	NA	0.00	NA
Total Suspended Solids (TSS)	NA	NA	NA	NA	0.00	NA
Total Nitrogen	NA	NA	NA	NA	0.00	NA
Total Phosphorus	NA	NA	NA	NA	0.00	NA
pH	Minimum	Maximum	Minimum	Maximum	0.00	NA

Part B – List each pollutant that is limited in an effluent guideline which the facility is subject to or any pollutant listed in the facility's NPDES permit for its process wastewater (if the facility is operating under an existing NPDES permit). Complete one table for each outfall. See the instructions for additional details and requirements.

Pollutant and CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-Weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-Weighted Composite		
NA	NA	NA	NA	NA	0.00	NA

Continue on Reverse

Continued from the Front

Part C - List each pollutant shown in Table 2F-2, 2F-3, and 2F-4 that you know or have reason to believe is present. See the instructions for additional details and requirements. Complete one table for each outfall.

Pollutant and CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-Weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-Weighted Composite		
NA	NA	NA	NA	NA	0.00	NA

Part D – Provide data for the storm event(s) which resulted in the maximum values for the flow weighted composite sample.

1. Date of Storm Event	2. Duration of Storm Event *(in minutes)*	3. Total rainfall during storm event *(in inches)*	4. Number of hours between beginning of storm measured and end of previous measurable rain event	5. Maximum flow rate during rain event *(gallons/minute or specify units)*	6. Total flow from rain event *(gallons or specify units)*
NA	NA	NA	NA	NA	NA

7. Provide a description of the method of flow measurement or estimate.

NA

EXCELERATE ENERGY

Aguirre Offshore GasPort Project

Thermal Plume Modeling Assessment - Water Use and Quality

July 11, 2012

Table of Contents

List of Tables

List of Figures

Table of Contents (Cont'd)

List of Figures (Cont'd)

1.0 Introduction

The following memorandum documents the results of the thermal discharge modeling for the Aguirre Offshore GasPort Project. This evaluation documents the modeling of the thermal discharges from a Floating Storage and Regasification Unit (FSRU) and a Liquidified Natural Gas Carrier (LNGC) at the Aguirre Offshore GasPort project off the southern coast of Puerto Rico, offshore from the inlet to Jobos Bay. Separate thermal discharges from the fixed FSRU, a permanently moored EBRV continuously providing natural gas to the Aguirre Power Plant, and an intermittently moored LNGC, transferring liquefied natural gas (LNG) to the FSRU will be considered.

Discharge and Ambient Characteristics

Heated discharge properties and ambient conditions were assembled for FSRU Outfalls 001 and 002 and are summarized in Table 1. Flow rates, port diameters, orientations, and depths below the surface were taken for vessel specification. It is assumed that the discharges exist normally beneath the vessel hull and due to the length of the vessels, ambient currents are parallel to the vessel. The temperature rise of 12 ^{o}C for the FSRU Outfalls was based on operating records and renewal of the Northeast Gateway National Pollutant Discharge Elimination System (NPDES) Permit. Less information is available for the LNGC discharge. Provided data include the 2.72 cm/sec discharge and the 3 ^{o}C temperature rises based on data from the Jordan Cove FEIS. Other port data were taken as the same as the FSRU Outfall 001. Ambient temperature data were taken. Other port data were taken as the same as the FSRU Outfall 001. Ambient temperature data were taken as the maximum mean monthly average surface temperature form the Metocean Study (Forristall, 2010). Mean lower low water (MLLW) depths were taken from the NOAA chart with a depth of approximately 18.3 meters. NOAA Etopo01 (http://www.ngdc.noaa.gov/mgg/global/global.html) depths for the region were slightly deeper with a value of 20.95 meters. Generally shallow depths are more critical with respect to plume mixing so a value of 19.2 meters (applying 0.67 chart + 0.33 etopo values for estimating ambient depth to bottom) was used. Detailed bathymetry data collected for the Aguirre Gasport Project confirm 18.8 to 19.1 meter depth intervals at the proposed location. The location of the vessel discharge port for Outfall 001 and 002 was modeled using the minimum and maximum depth ranges presented in Table 1. Discharge port depth for the LNGC was assumed to be similar to that for the FSRU (Table 1).

High current velocities tend to result in rapid mixing and high dilution rates making low current speeds more critical for plume temperature dissipation. For this study, two cases were considered, no ambient currents (0 m/sec) and a low ambient current speed of 0.10 meter/sec parallel to the vessel hull and normal to the discharge port orientation. Tidal current data on the southern coast of Puerto Rico is sparse with Morelock, et al (undated) estimating maximum tidal current speeds of 0.1 to 0.2 meters per second. Mean current are of a similar magnitude. Thus the two current cases considered in this analysis are very conservative.

Puerto Rico has a maximum temperature criteria of 32.2^{o} C (90^{o} F) which with is used to define impacted areas for the plume temperature field and the possible need for a mixing zone. The US EPA Technical Guidance (US EPA, 1991) defines a number of approaches for defining mixing zones based on discharge characteristic. The approach most appropriate for this situation is defining the mixing zone as a distance equal to 50 times the discharge length scale in all directions. The resulting mixing zone lengths are 62 and 17.5 meters (201 and 57 feet) for

Outfalls 001 and 002 respectively for the FSRU and 62 meters for the LNGC main condenser discharge,

2.0 Model Selection and Approach

A number of models are available for thermal jet-plume evaluation including CORMIX (Doneker and Jirka, 2007), VISUAL PLUMES (VP) (Frick, et al., 2003), and JETLAG/VISIJET (JETLAG) (Lee and Cheung, 1990: Lee and Chu, 2003; Choi and Lee, 2007) which model single and multiport discharges into a non-evolving ambient environment. For complex discharge situations where multiple, potentially interacting discharges, or the need to address potential recirculation into intakes, or the presence of evolving ambient conditions, the Environmental Fluid Dynamics Code (EFDC) model (http://www.epa.gov/ceampubl/swater/efdc/index.html), is recommended. The EFDC model is three-dimensional hydrodynamic and transport model which includes an embedded version of JETLAG making it possible to simulate multiple intakes and thermal discharges in high complex and evolving ambient environments.

All of the four proposed models are recognized and accepted by regulatory agencies. CORMIX and VISUAL PLUMES were developed by US EPA and are widely used for mixing zone studies. JETLAG is widely used internally and has been accepted for mixing zone studies in US EPA Region 4 (Tetra Tech, 2008a, 2008b, 2010). The modeling approach used in this study is to use all three models, CORMIX, VISUAL PLUMES and JETLAG to simulate the discharge plume primarily since CORMIX fails to provide complex results. The relatively short trajectories to the location meeting the 32.2^{0} C temperature criteria indicate that recirculation into the intake and tidal double dosing are not important and that an embedded buoyant jet in a larger scale EFDC model is not necessary.

Table 1. FSRU and LNGC Discharge Properties

Vessel Discharge Property	FSRU Discharge 1 Outfall 001	FSRU Discharge 2 Outfall 002	LNGC Thermal Discharge
Flow Rate, (cubic meters per second)	2.06	0.26	2.72
Discharge Port Diameter, (meters)	1.4	0.4	1.4
Port Area, (square meters)	1.54	0.126	1.54
Length Scale (square root of area), (meters)	1.24	0.35	1.24
Port Discharge Velocity, (meters/se)	1.34	2.06	1.34
Discharge Angle from Horizontal, (degrees)	-45	-45	-45
Discharge Angle form Ambient Flow, (degrees)	90	90	90
Discharge Depth Range, (meters)	5.3 – 7.4	6.3 -8.4	5.3 – 7.4
Discharge Temperature Above Ambient (^{0} C)	12	12	3
Maximum Ambient Temperature, (^{0} C)	29.6	29.6	29.6
Water Depth, (meters)	19.2	19.2	19.2
Mean Tidal or Ambient Current, (meters/sec)	0.10	0.10	0.10
Not to Exceed Temperature Criteria, (^{0} C)	32.2	32.2	32.2
EPA Guidance Mixing Zone (50 x length scale), (meters)	62	17.5	62

3.0 Model Results for FSRU Outfall 001

Model results for FSRU Outfall 001 are presented in Tables 2 through 4. Results for CORMIX are shown in Table 2. CORMIX predicts that the plume impacts the bottom but provides no vertical trajectory prior to impact. Once the plume impacts the bottom, the plume is modeled as a bottom attached half plume with dilution output as a function of distance from the discharge provided. For the case based on no current and discharge depths below the surface of 5.3 and 6.35 meters, the 32.2 ^{o} C, temperature criteria is met at 42 meters, which is within the proposed 62 meter mixing zone for Outfall 001. For the 0.10 meter/second current case, the distance to meeting the temperature criteria is reduced to 28 meters. For the 7.4 meter discharge depth CORMIX fails to provide solutions. Given the unsatisfactory performance of CORMIX, this model was not considered appropriate for the set of parameters applied and shallow water depths present. Therefore, additional simulations were conducted with VISUAL PLUMES and JETLAG to assess the thermal discharge

Table 3 shows results for the simulation using the VISUAL UM3 module for FSRU Outfall 001. The model behaves quite differently than CORMIX and does not impact the bottom but approaches the bottom and then rises towards the surface. For the three port depth cases, the no ambient current scenario identifies the temperature criterion to be met at horizontal distances of 12.2 and 13.4 meters. Depths to meet the criteria start at 9.6 meter and decrease by approximately a meter for the successive depths below the surface. With a 0.1 meter/sec ambient velocity, the horizontal distance is reduced 6.3 meters due to an increase in ambient water entrainment caused by the modeled current. Depths to meet the criteria are similar to the no current case with depths to attainment in the range of 9.6 to 11.7 meters (Table 3).

Results for the application of JETLAG to FSRU Outfall 001 are presented in Table 4. The JETLAG model predicts bottom impact of the plume based on the edge of the plume intersecting the bottom. However if bottom impact was based on plume center line impacting the bottom there would be not bottom impact and the plume behavior would be similar to the falling and rising trajectory of VISUAL PLUMES whose impact criteria were not available. For the no ambient current case, JETLAG predicts somewhat larger horizontal distances, (15.3 meters or less), to meeting the temperature criteria. For the 6.35 and 7.4 meter port discharge depths, temperature at bottom impact is slightly over the criteria, but the criteria should be subsequently reached in less than one meter due additional mixing in the bottom boundary layer. Depths at which the temperature criterion are met are also larger than those predicted by VISUAL PLUMES. For the cases with ambient current horizontal distance to meet the temperature criteria are 8.6 meters, again somewhat larger than the VISUAL PLUMES predictions. Depths at which the criteria are met range from 12.4 to 14.5 meters.

From these results it is seen that the VISUAL PLUMES and JETLAG models produce consistent results with JETLAG being slightly more conservative in predicting longer distances to meet the 32.2^{o} C temperature criterion. However these predicted longer distances remain well within the proposed 62 meter mixing zone for Outfall 001. To provide a feel for VISUAL PLUMES and JETLAG results, Figures 1 and 2 present the vertical plane trajectories for the 5.3 meter below the surface discharge port cases without and with ambient current using JETLAG. JETLAG results are presented due to JETLAG having more refined graphics capabilities than the VISUAL PLUMES software. JETLAG predicts the possibility for the discharge plume to come into contact with the bottom but only when considering the edge of the plume perimeter. Both

models do predict the plume to turn and dissipate with both ambient distance and current conditions

4.0 Model Results for FSRU Outfall 002

The discharge from FSRU Outfall 002 was simulated with only JETLAG due to limitation with CORMIX and VISUAL PLUME handling buoyancy dominated, downward discharge angles. The results of the JETLAG simulations are shown in Table 5. For the no ambient current scenario, the plume is buoyancy dominated and immediately re-orients from a downward to an upward trajectory as shown in Figure 3. The temperature criterion is met at a horizontal distance of 1.9 meters and a vertical distance of 5.1 to 7.2 meter below the surface for the 6.3, 7.35, and 8.4 meter port discharge depths. In actuality, the near vertical plume from Outfall 002 would hug the vessel hull as it rises to the surface. For the case with a nominal ambient current (0.1 m/sec) the plume is slightly deflected into the horizontal plane due to the influence of the ambient current momentum (see Figure 4) and the increased entrainment reduces the horizontal distance to which the criteria is met is 0.5 meters or less. Depths below the water surface at which the criteria are met range from 6.7 to 8.8 meters. The plume trajectory ends below the surface where the plume density and ambient density differ by less than one per cent. The plume with ambient current will also in actuality hug the vessel hull. In all cases the temperature criterion is met well within the proposed 17.5 meter mixing zone.

5.0 Model Results for LNGC Thermal Discharge

The only information for the LNGC thermal discharge is a discharge rate of 2.72 cm/sec and a projected temperature rise of 3^{o} C based on the characteristics of the Jordan Cove Project (FERC, 2009). In the absence of available data on port characteristics for the LNGC, the port diameter, orientation and discharge depths for FSRU Outfall 001 were used. Due to the 32 % higher discharge rate and four fold reduction in buoyancy, the jet plume will impact the bottom for all discharge depths. Since the CORMIX model does not provide complete information for a bottom impact situation, the LNGC thermal discharge was modeled only with VISUAL PLUMES and JETLAG.

Results for the VISUAL PLUMES simulations are summarized in Table 6. VISUAL PLUMES first output is the horizontal distance to sea bottom impact. Since the corresponding vertical positions are above the bed, it is inferred that bottom impact will be along the plume edges similar to JETLAG results for the FSRU predictions. Temperatures at the point of bottom impact are much lower than the discharge temperature of 32.6^{o} C and the criterion temperature of 32.2^{o} C. Horizontal distances to bottom impact range from 9.4 to 12 meters, well within the proposed 62 meter mixing zone based to 50 times the port length scale.

To get a more detail resolution of the jet-plume and the actual locations at which the temperature criterion will be met, JETLAG was used to simulate the 6 discharge scenarios summarized in Table 7. For the no ambient flow scenario, the temperature criterion is met at a horizontal distance of 0.82 meters. Corresponding depths at which the criteria are met range from 6.1 to 8.2 meters for discharges depths ranging from 5.3 to 7.4 meters. For the scenarios with a 0.1 m/sec ambient current, the temperature criterion is met at a horizontal distance of 0.41 meters (Table 7). Depths at which the temperature criterion are met range from 5.7 to 7.8 meters for discharge depths ranging from 5.3 to 7.4 meters. Graphical results corresponding to the 5.3 meter discharge depth case without and with an ambient current are shown in Figures 5 and 6,

respectively. Due to the high moment flux and small temperature rise, the 32.2^{o} C temperature criterion is met within less than a port diameter distance from the vessel discharge.

6.0 Potential for Bed Scour

The VISUAL PLUMES simulation for FSRU Outfall 001 did not predict interaction of the discharge plume with the sea bottom. JETLAG predicted some potential for interaction of the FSRU and LNGC plume edge with the sea bottom for the main condenser outfalls for all port depths. The 7.4 meter discharge depth cases for the LNGC thermal discharges resulted in the highest jet velocities at the point of bottom impact. Since the ambient current entrains more slower moving ambient water as well as deflecting the plume more to the horizontal, the case with no ambient current results in the higher impact velocity of 0.46 meters/sec. Assuming a conservatively stress coefficient of 0.025, the 0.46 meter/sec velocity produces a bed stress of 0.53 Pa (Newtons/square meter) and a corresponding shear velocity of 0.023 m/sec. For sand beds, the stability of the bed can be determined using the Shield's criteria for incipient motion (Garcia, 2008). For the 0.023 m/sec shear velocity, the stable sediment grain size is approximately 1 mm, which is the boundary between coarse and very coarse sand. When the first discharge of the plume occurs, material finer than 1 mm, if present, will be eroded with coarser material transported as bed load and finer material as suspended load. However with the initial removal of the fine material, the bed will be eventually be sorted and armor as the concentration of coarse material at the be surface increases.

7.0 Summary and Conclusions

The simulations and analysis summarized in this memoranda indicate that the 32.2^{o} C maximum temperature criteria will be met for the FSRU and LNGC thermal discharges well within calculated mixing zones based on the 50 times the port length scale (square root of port area) US EPA guidance (US EPA 1991). This conclusion is strongly supported by the unique approach of using three different buoyant jet models: CORMIX, VISUAL PLUMES and JETLAG. The unique characteristic of the discharges and ambient conditions results in FSRU Outfall 001 and the LNGC thermal discharge strongly interacting with the bottom or impacting the bottom. This interaction or potential for impact was not adequate in projecting bottom trajectory. For these two discharges, the CORMIX model did not provide the required level of results and the VISUAL PLUMES and JETLAG models were applied and yielded consistent results. For the initially downward but rapidly bending FSRU Outfall 002, the Lagrangian formulation of JETLAG provided detailed information which could not be obtained from the other two models.

For the FSRU and LNGC, the achievement of the 32.2 ^{o}C temperature criterion was attained well within the predicted mixing zones for all the modeled outfalls. The potential for interaction of the plumes with the sea bottom could result in some re-suspension and sorting of the bottom sediments. This effect however would be dependent upon the grain size of sediments present and the plume velocity at impact. Fine grained sediments such as silts and clays would be entrained and re-suspended in the water column during the early the initial start-up of the FSRU and LNGC operations. Available data for the sediments at the proposed the offshore terminal location indicate a mixture of coarse and shell fragments of a texture and grain size less prone to erosion based on project plume velocities near the bottom. The discharge velocity selected for the modeling effort chose a conservative value (the higher end of the range observed in similar vessels) and thus affords some degrees of conservativeness in the plume modeling exercise in predicting the interaction of thermal plume with the sea bottom.

Table 1. FSRU and LNGC Discharge Properties

Vessel Discharge Property	FSRU Discharge 1 Outfall 001	FSRU Discharge 2 Outfall 002	LNGC Thermal Discharge
Flow Rate, (cubic meters per second)	2.06	0.26	2.72
Discharge Port Diameter, (meters)	1.4	0.4	1.4
Port Area, (square meters)	1.54	0.126	1.54
Length Scale (square root of area), (meters)	1.24	0.35	1.24
Port Discharge Velocity, (meters/se)	1.34	2.06	1.34
Discharge Angle from Horizontal, (degrees)	-45	-45	-45
Discharge Angle form Ambient Flow, (degrees)	90	90	90
Discharge Depth Range, (meters)	5.3 – 7.4	6.3 -8.4	5.3 – 7.4
Discharge Temperature Above Ambient (^{o} C)	12	12	3
Maximum Ambient Temperature, (^{o} C)	29.6	29.6	29.6
Water Depth, (meters)	19.2	19.2	19.2
Mean Tidal or Ambient Current, (meters/sec)	0.10	0.10	0.10
Not to Exceed Temperature Criteria, (^{o} C)	32.2	32.2	32.2
EPA Guidance Mixing Zone (50 x length scale), (meters)	62	17.5	62

Table 2. Locations at Which Temperature Criterion Are Met for FSRU Outfall 001 Based on the CORMIX Model

Case	Discharge Depth, (meters)	Ambient Velocity, (meters/ Second)	Criteria (32.2^o C / 90^o F) or Bottom Impact Temperature, (^{o} C)	Horizontal Distance to Meet Criteria or to Bottom Impact, (meters)	Depth to Meet Criteria or to Bottom Impact, (meters)
1	5.3	0	32.2	42	19.2*
2	6.35	0	32.2	42	19.2*
3	7.4	0	na	na	na
4	5.3	0.1	32.2	28	19.2*
5	6.35	0.1	32.2	28	19.2*
6	7.4	0.1	na	na	na

* Bottom impact with no intermediate trajectory information provided

Table 3. Locations at Which Temperature Criterion Are Met for FSRU Outfall 001 Based on the VISUAL PLUMES UM3 Model

Case	Discharge Depth, (meters)	Ambient Velocity, (meters/ Second)	Criteria (32.2° C / 90° F) or Bottom Impact Temperature, (° C)	Horizontal Distance to Meet Criteria or to Bottom Impact, (meters)	Depth to Meet Criteria or to Bottom Impact, (meters)
1	5.3	0	32.2	12.2	9.6
2	6.35	0	32.2	12.2	10.7
3	7.4	0	32.2	12.2	11.8
4	5.3	0.1	32.2	6.3	9.6
5	6.35	0.1	32.2	6.3	10.8
6	7.4	0.1	32.2	6.3	11.7

Table 4. Locations at Which Temperature Criterion Are Met for FSRU Outfall 001 Based on the JETLAG Model

Case	Discharge Depth, (meters)	Ambient Velocity, (meters/ Second)	Criteria (32.2° C / 90° F) or Bottom Impact Temperature, (° C)	Horizontal Distance to Meet Criteria or to Bottom Impact, (meters)	Depth to Meet Criteria or to Bottom Impact, (meters)
1	5.3	0	32.2	15.2	15.5
2	6.35	0	32.4	13.1	16.0
3	7.4	0	32.6	11.5	16.4
4	5.3	0.1	32.2	8.6	12.4
5	6.35	0.1	32.2	8.6	13.5
6	7.4	0.1	32.2	8.6	14.5

Table 5. Locations at Which Temperature Criterion Are Met for FSRU Outfall 002 Based on the JETLAG Model

Case	Discharge Depth, (meters)	Ambient Velocity, (meters/ Second)	Criteria (32.2° C / 90° F) or Bottom Impact Temperature, (° C)	Horizontal Distance to Meet Criteria or to Bottom Impact, (meters)	Depth to Meet Criteria or to Bottom Impact, (meters)
1	6.3	0	32.2	1.9	5.1
2	7.35	0	32.2	1.9	6.2
3	8.4	0	32.2	1.9	7.2
4	6.3	0.1	32.2	0.5	6.5
5	7.35	0.1	32.2	0.5	7.6
6	8.4	0.1	32.2	0.4	8.8

Table 6. Locations at Which Temperature Criterion Are Met for LNGC Thermal Discharge Based on the VISUAL PLUMES UM3 Model

Case	Discharge Depth, (meters)	Ambient Velocity, (meters/ Second)	Criteria (32.2° C / 90° F) or Bottom Impact Temperature, (° C)	Horizontal Distance to Meet Criteria or to Bottom Impact, (meters)	Depth to Meet Criteria or to Bottom Impact, (meters)
1	5.3	0	32.2	<12.0*	<16.4*
2	6.35	0	32.2	<11.0*	<16.4*
3	7.4	0	32.2	<10.0*	<16.4*
4	5.3	0.1	32.2	<9.4*	<14.8*
5	6.35	0.1	32.2	<9.4*	<14.8*
6	7.4	0.1	32.2	<9.8*	<15.4*

* Trajectory too coarse to provide near port information

Table 7. Locations at Which Temperature Criterion Are Met for LNGC Thermal Discharge Based on the JETLAG Model

Case	Discharge Depth, (meters)	Ambient Velocity, (meters/ Second)	Criteria (32.2° C / 90° F) or Bottom Impact Temperature, (° C)	Horizontal Distance to Meet Criteria or to Bottom Impact, (meters)	Depth to Meet Criteria or to Bottom Impact, (meters)
1	5.3	0	32.2	0.82	6.1
2	6.35	0	32.4	0.82	7.2
3	7.4	0	32.6	0.82	8.2
4	5.3	0.1	32.2	0.41	5.7
5	6.35	0.1	32.2	0.41	6.8
6	7.4	0.1	32.2	0.41	7.8

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Figures

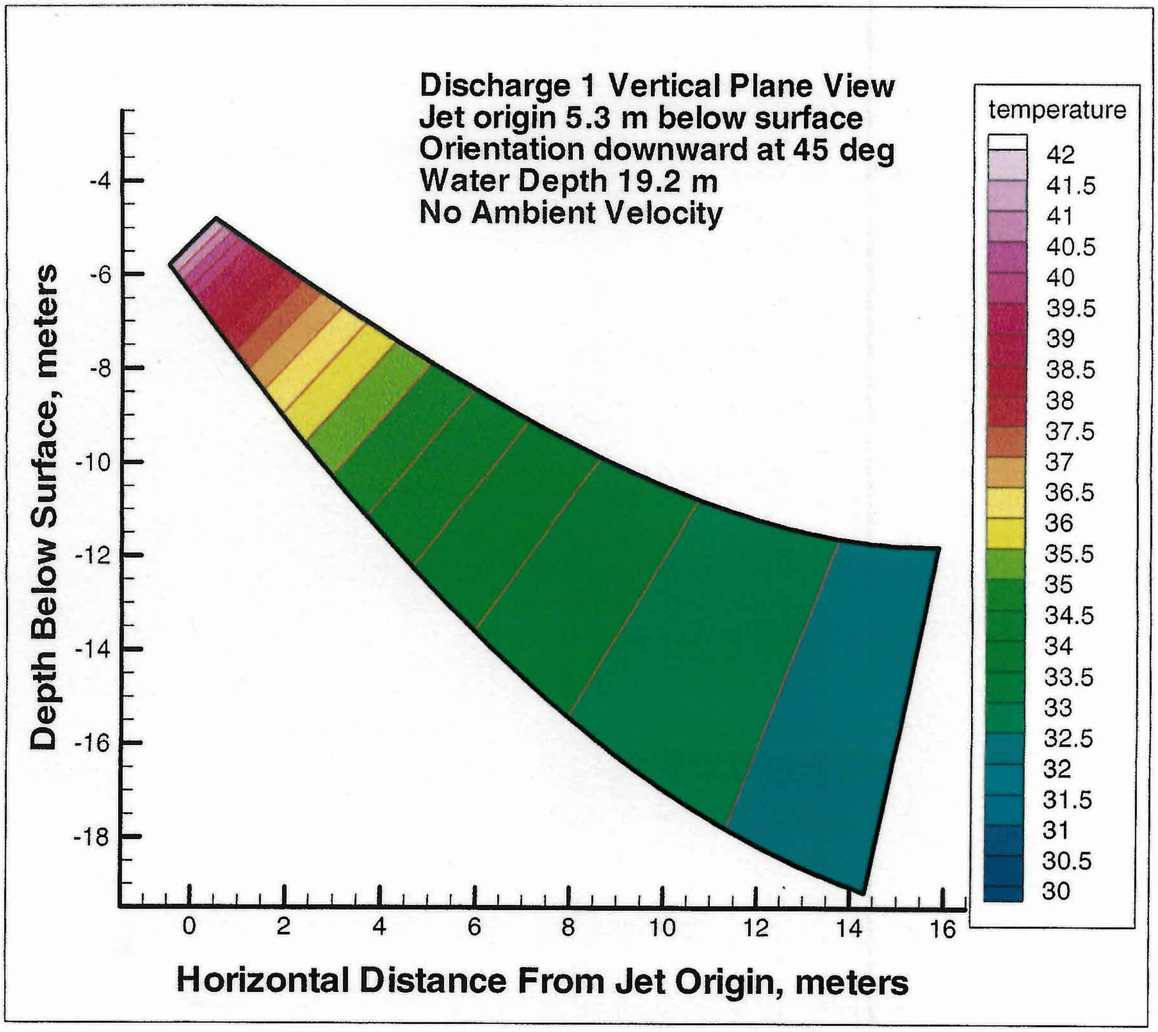

Figure 1. Vertical plane trajectory for FSRU Outfall 001 with Discharge 5.3 meters below surface and no ambient current

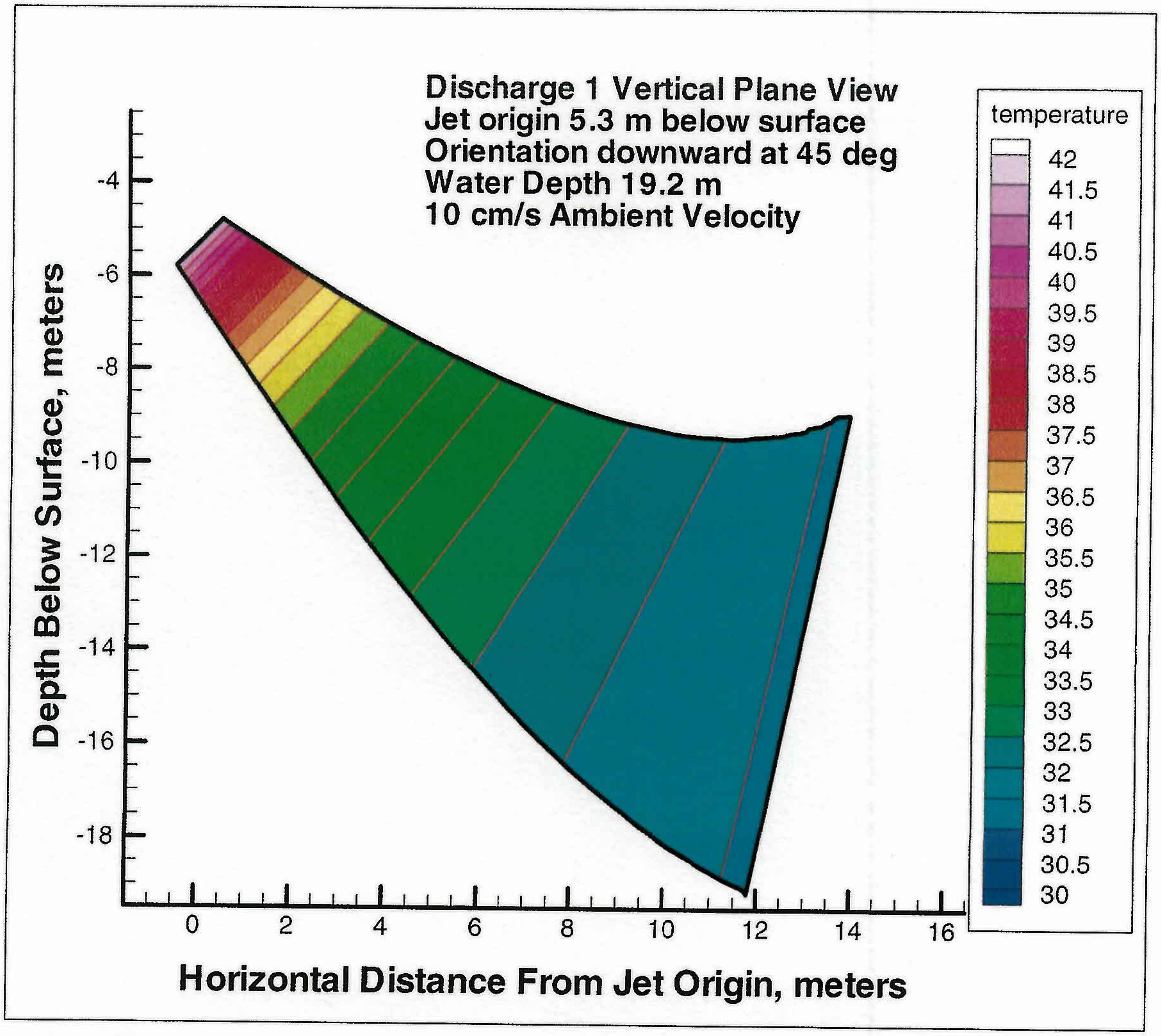

Figure 2. Vertical plane trajectory for FSRU Outfall 001 with Discharge 5.3 meters below surface and a 0.10 m/s ambient current

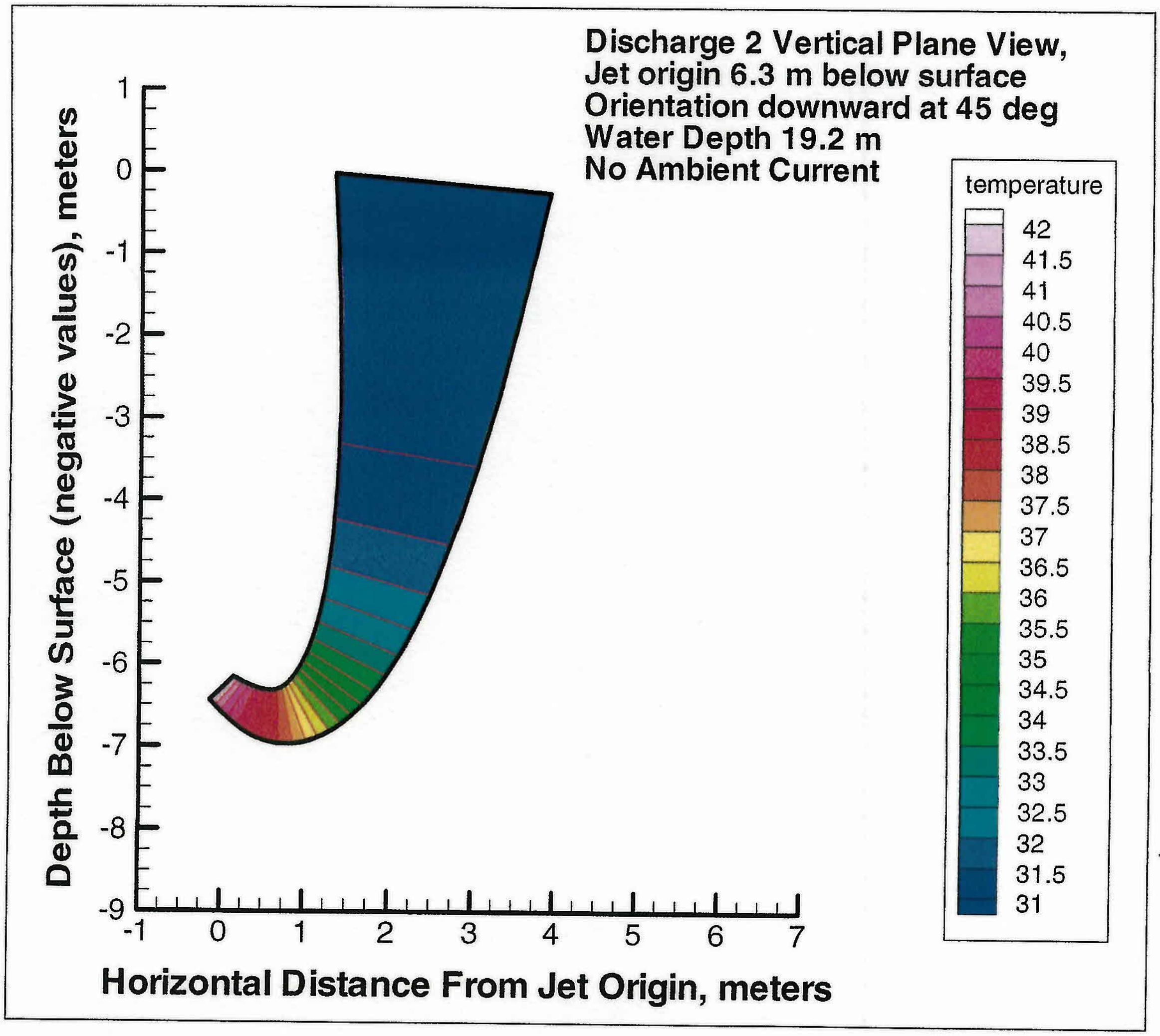

Figure 3. Vertical plane trajectory for FSRU Outfall 002 with Discharge 6.3 meters below surface and no ambient current

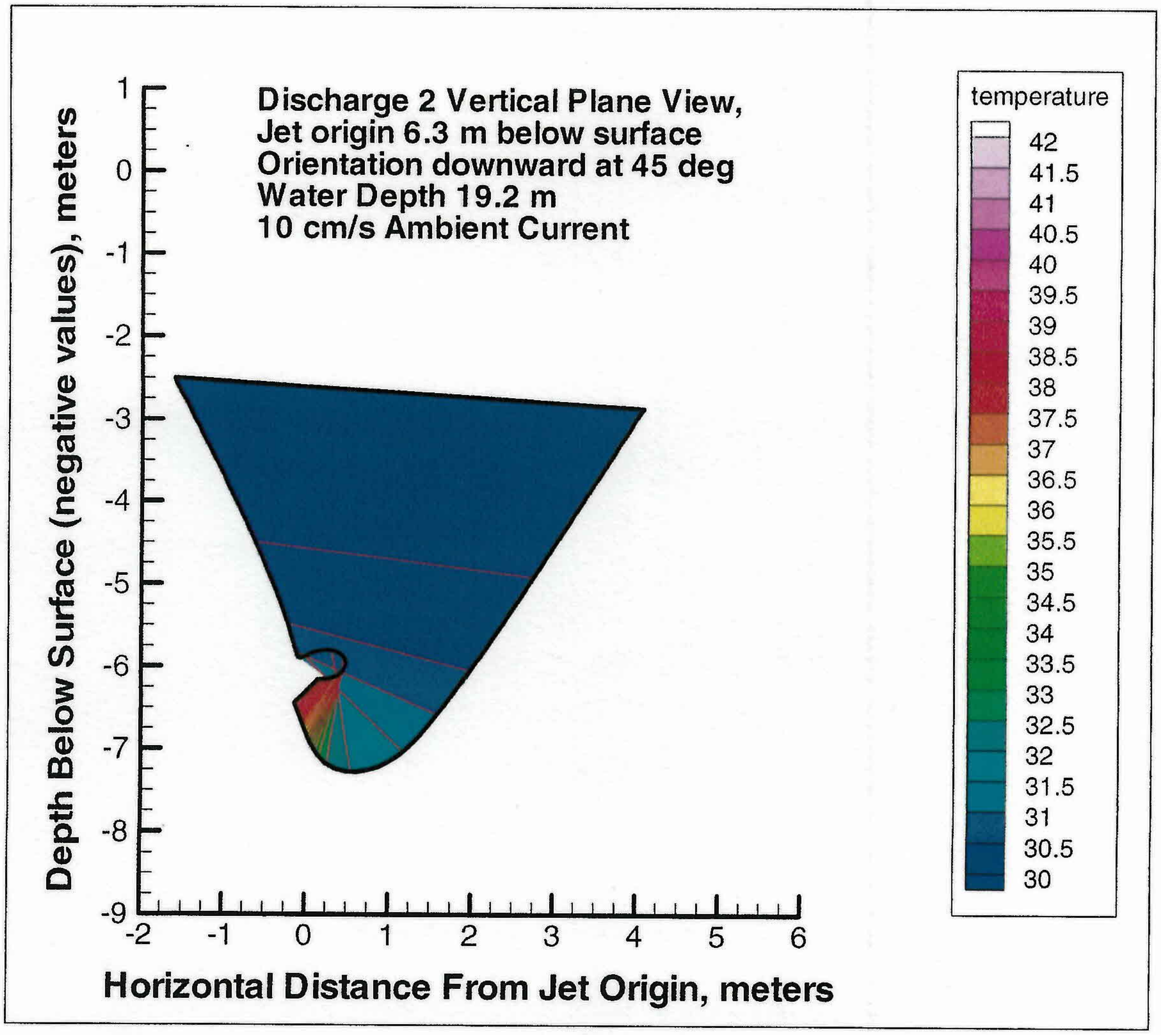

Figure 4. Vertical plane trajectory for FSRU Outfall 002 with Discharge 6.3 meters below surface and a 0.10 m/s ambient current

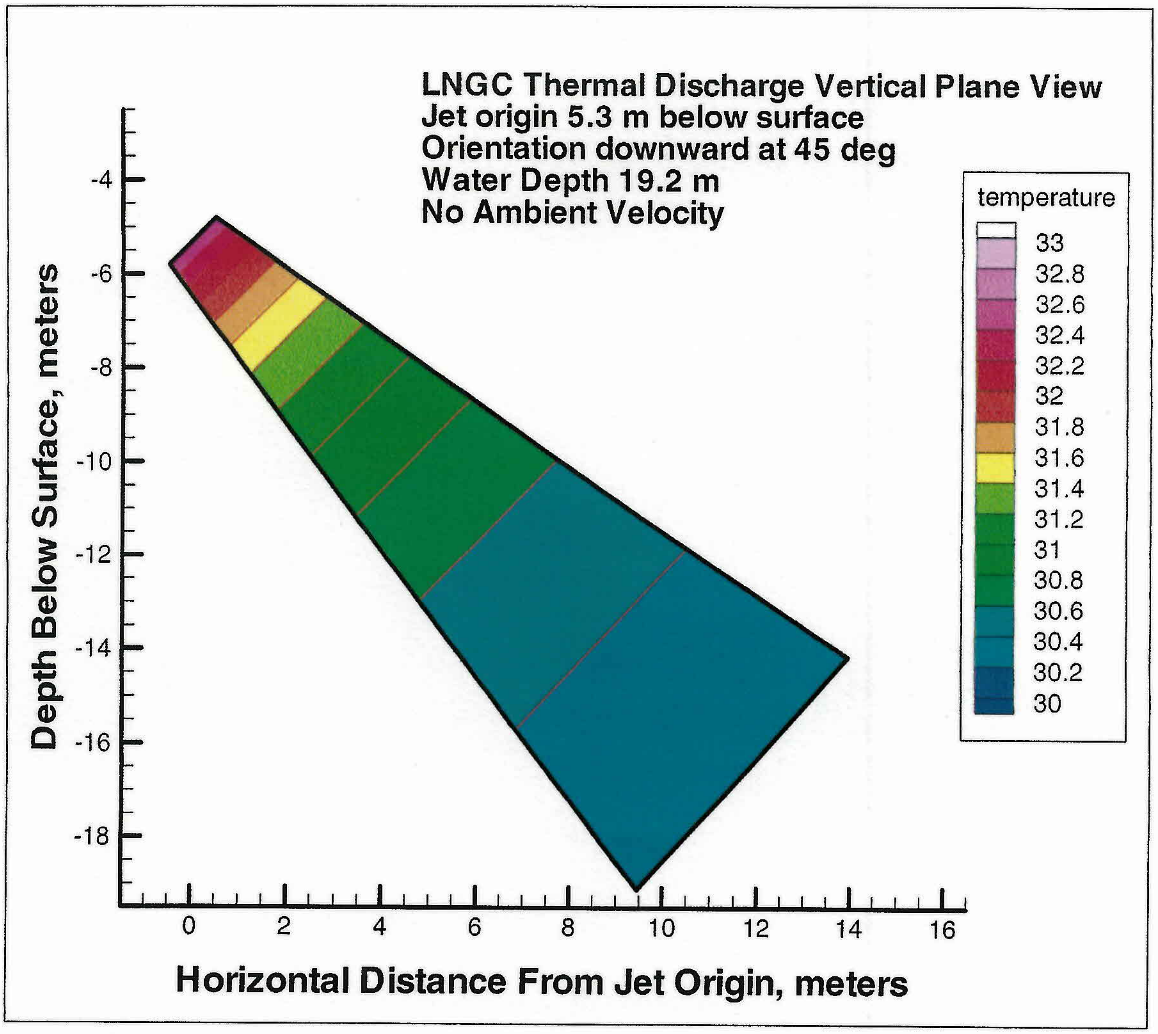

Figure 5. Vertical plane trajectory for LNGC Thermal Discharge with Discharge 5.3 meters below surface and no ambient current

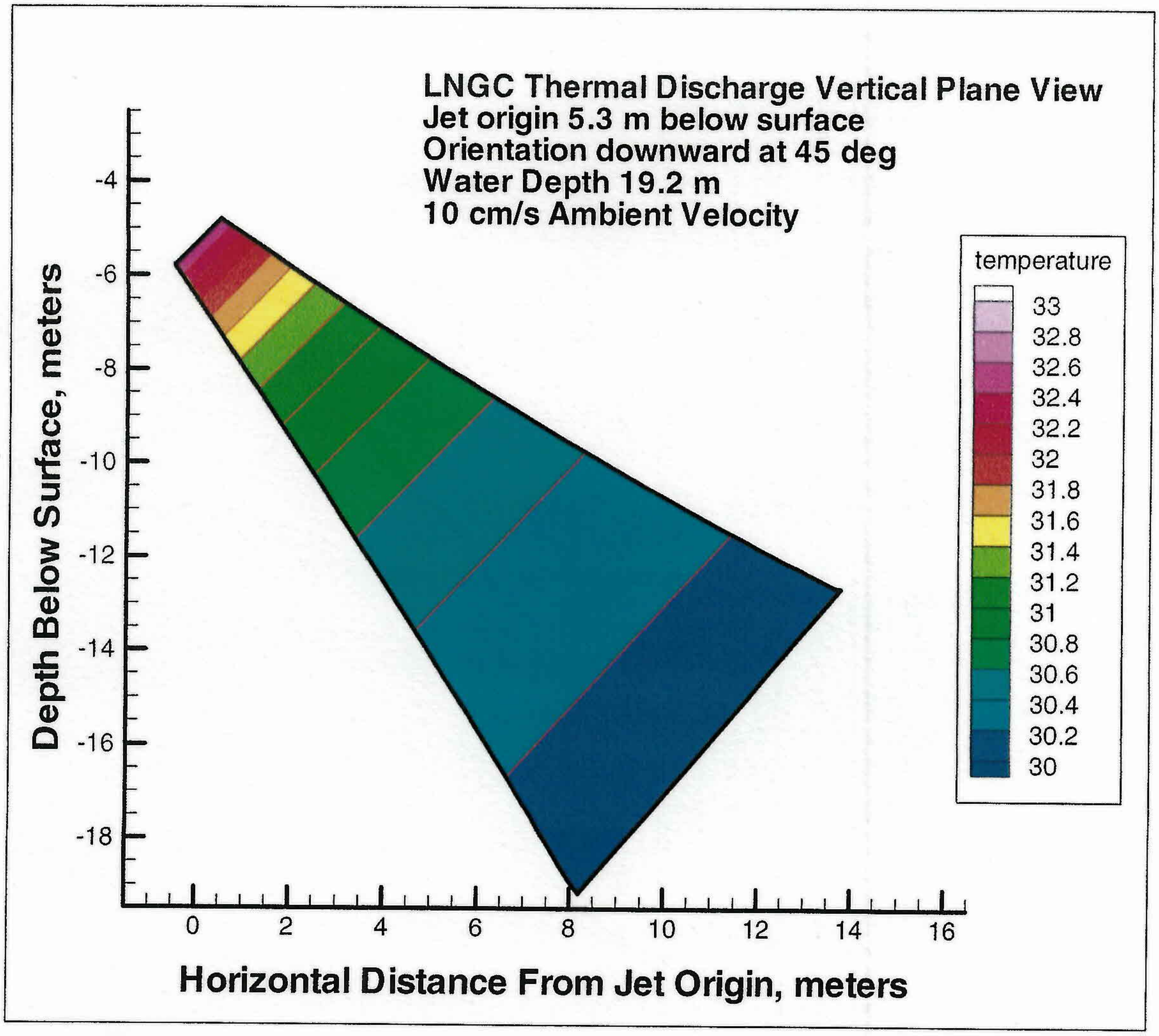

Figure 6. Vertical plane trajectory for LNGC Thermal Discharge with Discharge 5.3 meters below surface and a 0.10 m/s ambient current